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N. E. L. A. PROGRAMME.

To every one who attended the National Electric Light Association convention at Washington last week it must be apparent that the time has come for some important changes in methods of arranging the convention programme. This Washington programme served to bring to a crisis a situation which has been gathering for several years. Each incoming administration of the association has appeared to endeavor to outdo its predecessors in the volume of papers presented, with the result that it is no longer possible to present the papers even in abstract and leave time for the most valuable work of the convention, namely, the discussion. The whole atmosphere of the convention sessions was one of rush and hurry from beginning to end. When auditors feel that the time consumed in their remarks would disarrange the course of a programme the spirit of discussion is crushed, and most effectively in the diffident class who usually have most of value to impart. Conventions at the present day should not be for the purpose of hearing the reading of papers, or even of abstracts, which can be much better perused and mentally digested in quiet at home. They should rather be for the discussion of the subjects which the papers open up.

The feeling of dissatisfaction with the condition of affairs which has grown on the association is so widespread that the incoming administration must of necessity recognize it next year, either by a reduction in the number of papers to be presented so that they can be properly discussed, or the division of the convention into sections for the discussion simultaneously in different meeting rooms of subjects of interest to different classes of men. For such division there is ample precedent in other similar bodies. The American Street and Interurban Railway Association is now organized on this basis. In the case of this latter association, two subsidiary organizations had already sprung up in the field before the parent body wakened up to the fact that something must be done to recover its prestige. In the case of the N. E. L. A., sectionalizing or departmentizing would admit of no difficulty. If a vote of the active members had been taken at the end of the closing session at Washington there would have been few dissenters to the proposition that some radical changes are needed in the methods of formulating and conducting N. E. L. A. programmes.

Another probable change to be inaugurated next year is the perfection of some arrangement, such as was recently suggested in these columns, whereby the exhibit feature will be largely or wholly in the charge of exhibitors. Such an arrangement has become yearly more desirable. There was a period when the exhibit feature of the convention was pushed into the background, but this has been assuming new importance with the recent awakening of the central station indus-

try, the introduction of new illuminants and the development of the commercial department. If the exhibitors, through a committee, are authorized to relieve the association of providing and carrying out the exhibit plans, such action will doubtless be agreeable to all concerned.

Passenger Car Lighting.

The tests on different designs of steam railroad car lighting by incandescent lamps which were presented to the Chicago section of the Illuminating Engineering Society last week and summarized elsewhere in this issue, are certainly a striking testimonial to the importance of good design in such lighting. It would seem that of all places common-sense illuminating engineering would in the past have been employed in the design of this lighting, for the reason that it is for a portion of the time dependent upon storage batteries of limited capacity, and in other cases on a generating unit of limited capacity, so that economy is important. The cry of the passenger traffic department of railroads has constantly been for more light, and the result has been that the power demand per coach has been shoved up from year to year until it now assumes startling proportions, with poor results which are equally startling. The observation car tested by Mr. Keech, which contained incandescent lamps placed around the car without reflectors and without any attempt to reduce glare or deliver the light where passengers need it for reading, gave results on the passengers' reading level 42 per cent lower than the passenger coach in which the lamps were so placed and so equipped with reflectors as to deliver a large percentage of the light where it is needed. After such results as these, it would seem to be about time for steam railroad officials to cease the old talk about the difficulties of keeping reflectors clean, cost of maintenance, etc., and devote themselves to attempting really to give the passenger a good reading light without distressing him with a lot of glare in the upper portion of the car.

Good illuminating design for day car lighting is not at all difficult, and yet the great majority of electrically lighted railroad cars to-day are as wastefully equipped as is the most wasteful example given in Mr. Keech's paper, where it is shown that at the very least over 40 per cent of the energy is being wasted. For the lighting of day cars the plan of placing a row of downwardly pointed lamps over each row of seats and equipping these lamps with efficient reflectors which will deliver the greater portion of the light from a lamp at angles below 45 deg. from the horizontal, is undoubtedly going to find increased favor in the future on account of its efficiency and general practicability. The reflectors selected for such use should be deep, so as effectually to cover the lamp and allow only a well-diffused light to escape through the reflector to meet the eye of a person looking the length of the car. When such design of car lighting is more general, travelers will cease to be tortured with long rows of glaring lamps as they look down the length of a car, while at the same time being obliged to put up with illumination for reading that may be miserably insufficient. Passenger agents may clamor for a lot of glare from the upper portion of the car with which to create an impression on the loafers around the railroad station who do not have to ride on the train; but the real advertising that is valuable to a road comes from the satisfied actual passengers who know they can either read or rest in comfort during the evening.

Sleeping-car lighting is a somewhat more difficult problem, because of the presence of the upper berths. The majority of the electrically lighted sleeping cars operating in this country at present are an abomination to the man with weak eyes and a great aid to the business of the oculist because of the rows of low berth lamps which cannot be avoided by the eye of the passenger. A comparatively few of these cars have berth lamps so placed and equipped that they give good light for reading purposes in each seat and at the same time are shaded from the eyes of the other occupants of the car. When these exposed berth lamps were first introduced they were hailed by the traveling public as a great improvement; but the unfortunate traveler with weak eyes who has tried facing them for an evening has come to consider them rather an invention of the devil. As the majority of them now stand, they are nothing more or less than a concession to the desire of passenger agents to have something which looks pretty while the train is in the depot. Certainly no excuse other than this can be urged against properly shading these lamps.

Determining the Mean Horizontal Intensity of Incandescent Lamps.

The article by Messrs. Hyde and Cady on page 1260 of this week's issue, on the determination of the mean horizontal intensity of incandescent lamps, shows that there is considerable difficulty in making this measurement with some types of filament, owing to filament bending and light flickering. In other words, the mean horizontal intensity of a lamp is often a mean thing to measure. In commercial practice, the bending of the filament is not great, because the speed of rotation is low—about 200 r. p. m. For that very reason, however, the flicker error may be considerable with such types of filament as give rise to considerable variations of intensity in the horizontal plane. It is well known that the eye of the observer is unable to estimate the average value of visibly flickering illumination. One observer will persistently read such illumination high, or near to the upper limit, while another observer may persistently and unconsciously read low, or near the lower limit. All that can be said is that each individual's habit persists. In practice, the flicker error is only serious for certain types of lamp filaments. Ordinarily it is not of much importance. It may, however, become important when testing lamps carefully to ascertain whether they come up to specifications. In such cases, means should be employed to eliminate flickering in the illumination on the photometer screen, as by the use of a fixed mirror or mirrors near to the lamp and aiding in throwing its horizontal rays upon the photometer screen.

The article shows that when a lamp is rotated so rapidly as to bring the filament close to the glass wall, there is a local cooling of the filament in that neighborhood, with a slight but appreciable reduction in candle-power. When the filament actually touches the glass wall, this local cooling is evident not only in the reduction of total candle-power, but also in a slight change in the total resistance of the filament. At the speed of 800 r. p. m. attained in some of these tests, or 13.3 revolutions per second, the frequency of flicker would be about 27 cycles per second, since each revolution of the ordinary lamp gives rise to two alternate maxima and minima of

horizontal intensity. With the range of flicker ordinarily encountered, not exceeding 15 per cent, and with an illumination of not more than 0.5 foot-candle on the photometer screen, the flicker would probably be invisible at this speed. In fact, a 10 per cent flicker with 0.5 foot-candle on a photometer screen would probably vanish at a frequency of 20 cycles per second or 10 revolutions per second of the lamp. The expedient of employing an auxiliary stationary mirror in connection with a rotating lamp has the effect of not only greatly diminishing the range of flicker by making the illumination on the photometer screen more nearly uniform; but also of increasing the frequency of flicker, and thus diminishing the visibility of flicker in both these ways.

THE MUTUAL INDUCTANCE OF COAXIAL COILS.

It is one of the properties enjoyed by any pair of coils of insulated wire, situated anywhere, that they possess a coefficient of mutual inductance. The advantage of this coefficient is that it is ordinarily and conveniently regarded as equal to zero for pairs of coils whose component elements are remote. The disadvantage of this coefficient is that it is very hard to determine, either by experiment or computation, when the two coils of the pair are brought close together. Nevertheless, the importance of this coefficient may be considerable for particular scientific purposes, and among these for the determination of the ratio between electromagnetic and electrostatic units. For coaxial coils, wound with great care, the mutual inductance may be computed with great precision and Dr. E. B. Rosa in the last *Bulletin* of the Bureau of Standards shows how it may be possible to carry the precision of the computation to one part in fifty thousand.

LOW FREQUENCY INCANDESCENT LIGHTING.

A surprising feature in the history of electric lighting has been the persistency of the belief that no satisfactory illumination can be obtained from incandescent lamps operated with 25-cycle current. In spite of the fact that 25-cycle lighting has been used with satisfactory results for the past ten years in the city of Buffalo, central station companies have held to the belief that at this frequency incandescent lamps are subject to disagreeable flicker, and 60-cycle apparatus has been installed for the lamp circuits in addition to the 25-cycle apparatus for the motor circuits. In many instances expensive motor-generator sets have been used, for no purpose other than to change the frequency of 25 cycles to 60 cycles. It cannot be denied that arc lamps do not give satisfactory service at 25 cycles, but at the present day there appears to be little justification for the more or less prevalent idea that the same is true of incandescent lamps. The results actually obtained with 25 cycles lead one to accept as true the only reasonable explanation yet offered for the unsatisfactory results from early experiments with this frequency, namely, that the flicker observed was in each case properly attributable to a fluctuation in the effective value of the voltage due to defective speed regulation of the prime mover.

There are three distinct but interconnected series of phenomena involved in the increase of the "flicker" with a decrease of the frequency. The first of these is the prime cause for the flicker and relates to the cyclic fluctuation in the temperature of the lamp filament when the supply of heat energy thereto is non-uniform; the second, which is the connecting link between the first and third, is the change in the brilliancy of the filament coincident with the variation in its temperature, while the third is the effect produced upon the eye by the cyclic variation in the light received from the lamp. Even a superficial examination of the first mentioned set of phenomena will show that the temperature change in the lamp is a function of the ratio of the rate of radiating the received energy to the heat storage capacity of the filament. Thus by properly enlarging the diameter of the filament as the frequency is lowered, the percentage fluctuation in the temperature of the filament may be held constant or even increased. The law connecting the brilliancy with the temperature is somewhat complicated but the limits are well defined, and information concerning the actual cyclic change in the brilliancy of an incandescent lamp at various frequencies is not lacking. Messrs. Keilholtz and Branch, as the result of a series of carefully conducted tests, found that at 25 cycles a 16-cp, 50-watt, carbon-filament, 100-volt lamp changed in candle-power from a maximum of 17.4 to 14.9, and that a certain 15-cp, 46-watt, 27-volt lamp, which showed a variation of 11.7 per cent in luminous intensity at 42 cycles, suffered a variation of 28 per cent at 15 cycles.

The most difficult set of phenomena to deal with is the third, as classified above. For example, a certain percentage fluctuation in the brilliancy which would be unnoticeable at 42 cycles might be extremely disagreeable at 15 cycles. It is evident that when the frequency is decreased to a value so low that the eye ceases to transmit to the brain the average of the effect of the light throughout each cycle, the luminous intensity must be kept within certain ranges, or the illumination will be unsatisfactory. A valuable experimental investigation of the minimum frequencies at which certain variations in luminous intensity cease to be recorded by the eye as "flicker" was reported by Dr. A. E. Kennelly and Mr. S. E. Whiting at the recent convention of the National Electric Light Association, as noted on page 1208 of our issue for June 15. In the experiments reported the variation in illumination was definitely established by mechanical means, without any reference to the type of filament or the wave shape of current. Thus, the investigation dealt exclusively with the above-mentioned third set of phenomena, and the results obtained are general in their application. The investigation indicated that the eye is unable to detect any "flicker" whatsoever, quite independent of the range of brilliancy, when the frequency is above 55 cycles per second, and that at low frequencies no disagreeable flicker is noticeable when the range in brilliancy is properly decreased with decrease of frequency. In a particular experiment with a frequency of 2.5 cycles per second, the upper limit of discernible cyclic variation was 1.4 per cent, but a variation of 7.5 per cent, although discernible at certain low frequencies, was not found disagreeable. The limit of 1.4 per cent could not be reached in practice, but satisfactory results in central station work can be obtained with much higher limits. The experience at Buffalo and Baltimore indicates that 16-cp, 110-volt, carbon-filament incandescent lamps give thoroughly satisfactory lighting at 25 cycles, the variation being probably about 17 per cent. Similar lamps built for 8-cp at 55 volts would produce similar results at the same frequency. Even at a lower frequency lamps with heavier filaments can give equally as satisfactory service.

Annual Convention of the A. I. E. E.

In our issue for May 18 was printed a preliminary programme of the annual convention of the American Institute of Electrical Engineers, which is to be held at Niagara Falls, June 25 to 29. Following is the complete and revised programme. The Institute headquarters will be at the Cataract Hotel, and the meetings will be held at the same place.

TUESDAY, JUNE 25.

Morning Session.—Address of Welcome; President's address, "The Properties of Electrons," by Dr. Samuel Sheldon; "The Heating of Copper Wires by Electric Currents," by A. E. Kennelly and E. R. Shepard; "Interaction of Synchronous Machines," by Morgan Brooks; "Power-Factor, Alternating-Current Inductive Capacity, Chemical, and Other Tests of Rubber-Covered Wires of Different Manufacturers," by Henry W. Fisher.

Evening Session.—"Protective Apparatus Engineering," by E. E. F. Creighton; "Practical Testing of Commercial Lightning-Arresters," by Percy H. Thomas; "A Proposed Lightning Arrester Test," by N. J. Neall; "Inductive Disturbances in Telephone Lines," by Louis Cohen.

WEDNESDAY, JUNE 26.

Morning Session.—"Choke-Coils Versus Extra Insulation on the End-Windings of Transformers," by S. M. Kintner; "Protection of the Internal Insulation of a Static Transformer Against High-Frequency Strains," by Walter S. Moody; "Transmission-Line Towers and Economical Spans," by D. R. Scholes; "Lightning-Rods and Grounded Cables as a Means of Protecting Transmission Lines Against Lightning," by Norman Rowe; "Notes on Transformer Testing," by H. W. Tobey.

Evening Session.—"The Transmission Plant of the Niagara, Lockport and Ontario Power Company," by Ralph D. Mershon; "Location of Broken Insulators and Other Transmission-Line Troubles," by L. C. Nicholson; "A New Type of Insulator for High-Tension Transmission Lines," by E. M. Hewlett; "Some New Methods of High-Tension Line Construction," by Harold W. Buck; "Switchboard Practice for Voltages of 60,000 and Upward," by S. Q. Hayes.

THURSDAY, JUNE 27.

Morning Session.—Topical Discussions: (*a*) "Single-Phase Versus Three-Phase Generation for Single-Phase Railways," by A. H. Armstrong; (*b*) "The Choice of Frequency for Single-Phase Alternating-Current Motors," by A. H. Armstrong; (*c*) "Twenty-five Versus 15-Cycles for Heavy Railway Service," by N. W. Storer.

Afternoon Session.—Report of the Committee on a Code of Ethics. Papers: "The Attitude of the Technical Schools Toward the Profession of Electrical Engineering," by H. H. Norris; "The Concentric Method of Teaching Electrical Engineering," by Vladimir Karapetoff. The proposed revision of the standardization rules will be reported by the Standardization Committee.

FRIDAY, JUNE 28.

Morning Session.—"Regeneration of Power with Single-Phase Electric Railway Motors," by William Cooper; "Fractional Pitch Windings for Induction Motors and Alternators," by C. A. Adams, W. K. Cabot, G. Æ. Irving, Jr.; "The Vector Diagram of the Compensated Single-Phase Alternating-Current Motor," by W. I. Slichter; "Zigzag Leakage of Induction Motors," by R. E. Hellmund.

Afternoon Session.—"Commutating Pole Direct-Current Railway Motors," by E. H. Anderson; "Track-Circuit Signaling on Electrified Roads," by L. F. Howard; "Some Power Transmission Economics," by F. G. Baum; "One-Phase High-Tension Power Transmission," by E. J. Young.

ENTERTAINMENT.

The local committee has arranged the following events: Tuesday afternoon, June 25, trolley trip through Niagara Gorge. Tickets cost about $1 for each person. Wednesday afternoon, June 26, afternoon tea at Natural Food Company's conservatory, 4 to 6 p. m. Thursday morning, June 27, automobile trip for the visiting ladies. Thursday evening, June 27, reception, Cataract Hotel, at 9 p. m.

The usual concession of one-third fare for the return trip on the certificate plan has been granted by only three of the passenger associations this year, viz., New England, Trunk Line and Eastern Canadian.

Schenectady A. I. E. E. Branch.

During the past Institute year, the Schenectady branch of the American Institute of Electrical Engineers held 33 meetings, at which 25 original papers were presented; papers presented at New York were discussed at four meetings. The membership increased from less than 200 in 1906 to more than 900 at present. Of these, 191 are members of the Institute, the others being affiliated members who pay an annual fee of $2 in the case of "full" members and $1 in the case of student members. During the year the Institute membership at Schenectady increased from 132 to 191. The meetings are held in the auditorium of the High School, having a seating capacity of 900, but at the first meetings the crowding was so great that thereafter admission was by ticket only. The receipts during the year were $1,276.79, leaving a balance over expenses of $773.58. The expenses of delegates to attend New York meetings were paid, and a contribution of $50 made to the Schenectady public library. The expense of several smokers were also paid from the membership fees. Following are the officers elected at the annual meeting held May 23:

Honorary chairman, Dr. C. P. Steinmetz; chairman, Mr. D. B. Rushmore; vice-chairmen, Messrs. E. H. Anderson, A. H. Armstrong, E. A. Baldwin, E. E. F. Creighton, William Dalton, G. H. Hill, E. B. Merriam, A. L. Rohrer, C. W. Stone; corresponding secretary, Mr. W. C. Andrews; recording secretary, Mr. J. M. Knox; treasurer, Mr. A. S. Kappella; librarian, Mr. H. E. White.

Technical Welfare Work in Brooklyn.

Prof. Sydney W. Ashe, of the Brooklyn Polytechnic Institute, sends us some interesting data as to educational work done recently among the employees of the Edison Illuminating Company of Brooklyn to give technical knowledge to those who felt their lack of it. The course of lectures organized for the purpose consisted of 12, but might better have been 20. One lecture a week seems to be about the practical and desirable periodicity. Very satisfactory results were obtained and Prof. Ashe makes the following suggestions:

Considerable apparatus is necessary for such courses and a large amount of time is necessary in the preparation of the experiments, setting up the lecture beforehand, transporting apparatus, etc., but the results more than justify all this. Apparatus should be arranged on the table so that as little time as possible shall be consumed making set-ups. Whenever a motor or any apparatus is used for the first time, the connections should be made during the lecture so that the audience will obtain the procedure. Each step should also be explained and a diagram of the set-up, no matter how simple, should be drawn on the blackboard. When measuring the resistance, say, of the field coils of a motor, the ammeter and volt-meter readings should be projected on the screen if the direct method is used. Not too much mathematics should be used or when the Greek "π" is used someone may ask—whether pie plus doughnuts equals dyspepsia—as actually occurred to the writer. Last winter 12 lectures were given. The attendance varied, being 170 as a maximum and 56 as a minimum on a very stormy night. The total attendance was 1291 men, or an average of about 107 men per lecture. There were about 75 men who attended quite regularly, the others varyingly. The attention of the men was excellent and the result was very satisfactory.

In order to get a satisfactory attendance the following method is suggested: First, the preparation of a syllabus comprising notes on the lectures; second, the preparation of notices of each individual lecture which should be posted on the bulletin boards at least three days before each lecture; third, the co-operation of the various department heads, and finally, last but by no means least, the lectures should be properly prepared and properly given. The only form of lecture which will maintain interest is experimental. Each lecture should start promptly at 8 o'clock—not later, not earlier. With each lecture should be given about 18 experiments. Actual observations should be made by arranging ammeters, voltmeters, galvanometers, etc., so that readings may be projected on the screen. Lantern slides, blackboard illustrations, simple problems, should form part of the lecture. The lecturer should be both theoretical and practical, primarily a teacher, and should not get beyond the reach of his audience. He should have a cool head, an appreciation of humor, and should not get confused when asked questions. He should make his audience feel that he is one of them. The lectures should be general, starting in with magnetism, proceeding to direct and alternating currents. The first year only the elementary principles and operating features should be dwelt upon with a view to future treatment. Lectures on the practical manipulation of shunt motors, the transformer, electrical measurements, the rotary converter, electrolysis, etc., can be demonstrated to excellent advantage with the apparatus on the lecture table, and with projections on the screen.

Mercury Vapor Lamps for Industrial Plant Illumination.

At the meeting of the New York Section of the Illuminating Engineering Society, held on June 14, a paper by Mr. George C. Keech, which had been presented before the Chicago Section on May 9, was read by Mr. A. S. Hubbard. An abstract of this paper was given on page 1018 of our issue for May 25. The paper compared the illumination by mercury vapor lamps with that obtained with enclosed arc lamps and carbonized filament incandescent lamps, and the data given indicated that the mercury vapor lamp produced at least twice as many foot candles per watt per square foot as either the arc lamp or the incandescent lamps.

The discussion was opened by Mr. A. D. Childs, who related the history of the development of the mercury vapor lamp. When this lamp was first introduced it met with considerable opposition on account of the color of its light. At the present time, however, it is not found so objectionable because people have become accustomed to it, and the lack of red rays is not considered a detrimental defect. The light is soft, and is easy on the eyes. The lamp is especially advantageous for use in factories and such places. A certain Western factory about four years ago ordered eight lamps for trial, and found them so satisfactory that it ordered more lamps from time to time, and now has about 150 in use. Printing offices have had similar experiences, and at the present time most of the newspapers in New York City use mercury vapor lamps in their composing, printing and mailing rooms. Mercury vapor lamps are employed for illuminating about 12 of the steamship piers in New York City, each pier using from 8 to 15 lamps.

Mr. V. R. Lansingh called attention to the illuminating unit "foot candles per watt per square foot" as used in Mr. Keech's paper. He expressed the opinion that this unit is a most valuable one and should be given a short, distinctive name. He criticized the author for comparing the illumination obtained from mercury vapor lamps with that from three-ampere arc lamps and with relatively inefficient incandescent lamps, and stated that the comparison would have been less favorable to the mercury vapor lamps if the arc lamps had been of a modern type and metallic-filament incandescent lamps had been used.

Mr. E. L. Elliott gave a striking demonstration of the poor economy resulting from the use of defective illumination in industrial plants. He showed that the amount of money saved by omitting a 16-cp lamp from the lighting equipment of a machine would represent only a few minutes per day of the wages paid to the workman. It can easily be seen, therefore, that a workman may waste more in wages on account of the lack of proper illumination than the company can possibly save by omitting the lamp. He agreed with Mr. Lansingh as to the advantage of using "foot candles per watt per square foot" as the unit of illumination. Upon a suggestion by Mr. M. K. Eyre it was decided to refer the matter of selecting a name for this unit to the committee on nomenclature.

Mr. P. H. Thomas stated that the paper of Mr. Keech is valuable from an illuminating standpoint, both on account of the methods employed and of the results obtained. In comparing the illumination from an arc lamp with that from a tube lamp, one should remember that the intrinsic brilliancy of the former is many times greater than that of the latter. Thus, when the space is illuminated by an arc lamp the pupil of the eye is much more contracted than is the case when tube lamps are used, so that much less light reaches the eye from the illuminated object with the former lamp than with the latter, although the average illumination may be the same in one case as in the other. An advantageous feature of the tube lamp is that no shadows are produced. The mercury vapor lamp is less affected by voltage variation than any other type, with the exception of the Nernst. This characteristic is attributable to the ballast resistance used in series with the lamp. It is incorrect to assume that the light from the mercury vapor lamp is monochromatic. As a matter of fact, the spectrum shows that all colors are present with the exception of red.

Mr. P. S. Millar called attention to the fact that, although a luminometer is extremely convenient for comparing illumination obtained from different lighting equipment, it is not proper to attribute to it any extreme accuracy; as a matter of fact, the readings obtained from the luminometer are subject to an error of at least 20 per cent. A luminometer is merely a portable photometer, and even under laboratory conditions a photometer cannot be considered accurate within 5 per cent.

Mr. J. S. Codman, of the committee of arrangements for the annual meeting of the Illuminating Engineering Society, gave an outline of the arrangements which have been made for the meeting in Boston during Old Home Week. The convention will be held on Tuesday and Wednesday, July 30 and 31. The headquarters will be located at Room 728 of the Old South Building. The opening session will be addressed by the Mayor of Boston, and it is stated that numerous interesting papers have been promised by leading representatives of the various interests which the membership of the society includes.

The chairman of the New York Section, Mr. A. E. Forstall, stated that the next New York meeting will be held in October.

Chicago I. E. S. Car-Lighting Meeting.

The Chicago section of the Illuminating Engineering Society held a meeting June 13 at which Mr. George C. Keech presented a paper giving the results of measurements of illumination taken on railroad cars lighted by different methods. The first set of tests was made on three mail cars of the Rock Island System, these cars being exactly alike except as to lighting arrangements.

One car equipped with seven of the ordinary four-burner Pintsch gas lamps 7 ft. 3 ins. from the floor gave an average of 1.32 foot-candles in the test planes, these test planes being at the points where the light is needed by the mail clerks in handling mail.

A similar car equipped with 31 incandescent electric lamps of 192.5 watts gave an average of 8.85 foot-candles, the foot-reflectors installed in rows over the points to be illuminated gave 2.2 foot-candles average, the foot-candles per watt per square foot in this case being 1.7.

A similar car equipped with three mercury-vapor lamps each

of 192.5 watts gave an average of 8.85 foot-candles, the foot-candles per watt per square foot being 7.69. This mercury-vapor lamp equipment has been running about 900 hours.

Tests were made on four different passenger cars with different electric lighting arrangement. These tests were made especially to determine the illumination on the reading page of a person as ordinarily seated in a car, this plane being taken as 60 deg. from the horizontal. A Chicago & Northwestern passenger coach equipped with three 250-watt enclosed arc lamps gave an average value in foot-candle per watt per square foot of .629. The variations between maximum and minimum readings were, however, very great.

A chair car on the Chicago, Milwaukee & St. Paul, equipped with a row of incandescent lamps in concentrating prismatic reflectors over each row of seats and also a row of lamps over the center of the car, took 2.13 watts per square foot and gave .69 foot-candles per watt per square foot.

A parlor car with six three-light clusters over the center aisle equipped with porcelain dome reflectors and a row of side brackets at an angle of 45 deg. with opal bell reflectors took 2.42 watts per square foot and gave .644 foot-candles per watt per square foot.

An observation compartment with bare lamps on high side brackets without reflectors required 8.34 watts per square foot, giving only .407 foot-candles per watt per square foot.

Vice-president Scheible, who acted as chairman of the meeting, called attention to a test made by Prof. George D. Shepardson on electric train lighting on the Burlington Route a number of years ago in which he obtained values of from 1.06 to 1.98 foot-candles in a horizontal plane at about the level of the reading page. The reason for taking horizontal illumination in that case was stated to be that no two people held their papers exactly alike and there was likely to be constant shifting, so that horizontal illumination represented practically the average condition.

Mr. W. Bentley gave the results of some tests made by Mr. A. L. Eustace, of Armour Institute, which corresponded very closely with those made by Mr. Keech, on the same arc-lighted car. Mr. A. J. Farrelly, of the Chicago & Northwestern Railway, condemned the arc lamp as a satisfactory reading illuminant for use in cars because of the sudden and extreme variations in light due to the shifting of the arc around the carbon points. He said the first impression upon one entering the car was good, but that reading by such light was very unsatisfactory. The variations were about four to one due to shifting in the arc.

Mr. C. R. Gilman, of the Chicago, Milwaukee & St. Paul Railway, called attention to the great difference as shown by the tests in the illuminating results in the chair and parlor cars as compared with the observation compartment, this difference being due to improper design and the absence of reflectors in the observation compartment. Conditions in this observation compartment were probably about the average conditions found in electric train lighting to-day and this paper showed what great improvements could easily be made. On his road the question of getting sufficient current supply for long, heavy trains with extravagant lighting arrangements was making it necessary to consider a reduction in the candle-power of lamps, and this reduction could only satisfactorily be made by using proper design and reflectors.

Mr. J. R. Cravath expressed the opinion that the best designed car lighting in the future would employ rows of lamps over the seats, the lamps to be well covered by deep opal or prismatic reflectors of such a shape as to distribute a large percentage of the light down on the seats, while at the same time sufficiently covering and diffusing the light from the bare lamps as to hide the lamps themselves from view when looking the length of the car.

Mr. William S. Hamm spoke strongly in favor of the use of dense opal glass as a diffuser between the eye and bare sources of light. He also spoke of some pleasing effects obtained on recent Santa Fé cars with rows of electric lamps placed under the edge of the deck, leaving the center clear and unobstructed. Some question was raised as to whether the unobstructed center would not look bare, but one speaker pointed out that the only reason for placing lamps in the center aisle heretofore has been that there has been no other place to put them with oil and gas as illuminants.

The Report of the Massachusetts Lighting Commission.

The board of gas and electric light commissioners of Massachusetts has just issued its twenty-second annual report for the year 1906, and the document is as usual one of great interest to all engaged in the field of light and power. It embraces 218 pages of report and 200 pages of appendices. The board now has under its supervision 146 companies, and the gas and electric plants of 19 towns and 3 cities, making 168 systems in all. Of the companies, 70 supply only electricity, 50 supply only gas, and 26 supply both. Amongst the municipal systems, 18 plants furnish electricity only, and 4 furnish both gas and electricity. In an old and settled state like Massachusetts few newcomers present themselves, and during the year but four companies took out public utility charters for gas or electricity with a total capital of only $280,000. None of them had gone into actual business.

It is, of course, with the electric lighting companies that we are more particularly concerned. These showed for the year a total income of $8,927,918, a gain of nearly $820,000 over the previous year. Of this income $5,196,310 was derived from the sale of metered current for lighting by meter, $1,485,251 from public arc lighting, $427,132 from public incandescents, and $1,326,489 from the sale of electric power. From contract commercial arc lighting, $125,929 was derived; and from commercial contract incandescents $179,819. As the electric power service is very largely on a metered basis, it will be seen that extremely little of the electric lighting business in the state done by private companies is on flat rates. In spite of this large income, four of the companies lost money, and 26 others were unable to declare dividends. The total assets were $34,393,621, of which $29,775,616 was for construction account and franchises; and the liabilities were $32,405,205, to which should be added $542,152 for depreciation and reserve, leaving a total surplus of $1,446,263. As a matter of fact, however, 11 of the companies showed an aggregate deficit of $117,369, which should be added to the other amount to bring out the actual surplus of the 49 companies on a sounder basis. The sum paid out during the year for interest was $326,892, and for dividends $1,647,088. Five of the companies paid dividends at the rate of 10 per cent, three at the rate of 9, eight at the rate of 8, one at 7½, two at 7, and the others tapered off to 2½.

The report shows that there were on the companies' circuits 1,677,310 lamps of 16 candle-power, 806 of 20 candle-power, 6000 of 32 candle-power, which probably accounts for all the incandescent service, as none were returned of 10 candle-power or lower, although doubtless there were some in electric signs, etc. The arc lighting included 140 lamps of 800 candle-power, 4963 of 1200 candle-power and 9976 of 2000 candle-power, no distinction being made as to open, enclosed or flaming in the different candle-powers, but the table of arc lamps in service shows only 2046 single and double lamps, while in Boston alone 10,043 enclosed lamps were reported. Details are also given as to the motors in use, there being 10,322 on lighting circuits and 882 on power circuits, or a total of 11,214. The Boston Edison system had 8319 motors on its mains of 30,431 horse-power. No income is reported from electric heating, although we know there was a good deal, but there was noted $25,082 from steam heating. The Boston Edison system was, of course, the largest producer of electrical energy, and reported over 74,000,000 kilowatt-hours generated or about twice as much as the rest of the state put together. Rates for energy ranged from 20 cents downward to 3 cents, depending on location, quantity, size of plant and the

usual determining conditions. Several of our recent articles on New England plants have quoted the scales in detail.

When we come to the municipal plants, it is realized how small is the scale on which they do business and how little real figure they cut in the total service given to the public. The aggregate assets, electricity and gas plants together, are placed at the sum of $3,646,131. The municipal expenditure for town and city electric lighting, with depreciation at 5 per cent, is carefully estimated to have amounted to $186,078. From commercial business the plants derived an income of nearly double this, viz., $374,031, but showed an apparent loss in operating account of $16,244. Of this income $174,673 came from commercial incandescents, and $105,322 from domestic, while not less than $65,554 was derived from the sale of electric power. Only $9,977 was earned from commercial arc lighting. It is evident, of course, that this commercial income does much to help out the municipal plants, several of which would otherwise be in desperate straits. A table compiled by the commission to show the cost to the municipalities of their self-supplied street lighting, shows a cost at Middleborough of not less than $125 per year for all night 1200-cp lamps, which are the favorites with plants of this type in New England.

A large part of the text of this valuable report is devoted to a discussion of sundry disputes and references, petitions from companies, municipalities and private persons as to rates, franchises, capital, etc. Some of these of importance have already been noted in our columns. Mention is made of the fact that 36 meter inspection tests were made by request, with such variations as might be expected, at different loads. Thirteen of the meter tests were made on the application of the companies themselves. Only seven of the meters were above 50 amperes capacity. This meter testing service appears to have cost $283, but the fees from applicants are returned as amounting to only $83.

With regard to the showing of the municipal plants, it is perhaps only fair to the commission to quote its method of estimating the cost of service. The report says: "The table (of street lighting) is compiled to indicate, as nearly as may be from the data available, the cost per lamp per year of the street electric lights in the several municipalities, as determined by the items shown and upon the average daily number of lights used during the year as given in the first table. The apparent loss in operating is the difference between the operating expenses and the income from private consumers. Interest is computed upon the total investment at the beginning of the year, at the rate paid upon the bonds or notes, and depreciation at the rate of 5 per cent upon the cost of the plant as shown by the books at the beginning of the year. Whenever the lights are of different kinds or candle-powers, the total cost obtained in the manner indicated is apportioned to each kind according to the amount of energy theoretically necessary under average conditions to maintain the lights at the standard candle-power. The table is devised upon the theory that for all its expenditure the municipality receives only its street lighting and the income from its commercial business, and that the cost of the former to the city or town is the difference between such income and the entire cost of carrying on the business. Obviously, such cost is affected by the profit or loss on the commercial lighting. The value of the interior lighting supplied to municipal buildings is allowed in the computations at a fair amount, as determined by the respective managers."

Another interesting citation is that which may be made from the decision of the board in the Quincy appeal, when it decided to allow the company to charge a maximum rate as high as 17 cents per kw-hour. It said: "More than two-thirds of the company's output and probably an equal proportion of its investment is for street lighting alone. The company's prices for this service have gradually tended downward, until they have reached a point which barely meets the operating cost, with no provision for depreciation, interest or dividend, and the entire burden of such charges is thus thrown upon the supply to private consumers. While the board is unwilling to approve the policy which has brought about these conditions, it has no authority to increase these prices. We are not familiar with the reasons which have led to them, nor are we prepared to say that, having been now reached, they ought to be increased. It is very plain, however, that the facts are of such importance that they control the situation, and that, if the price for street lighting were increased, a corresponding decrease might be made in the commercial lighting price. The company's entire business has hitherto yielded to its stockholders no more than a fair and reasonable compensation for all the service it renders to the public. The fiscal year ending June 30, 1906, showed an encouraging increase in its volume. The probable maintenance of the present output will enable the company to make some reduction in its commercial lighting rates. Any further reduction is likely to come only from some improvement in the rates for public lighting, a further increase in the volume of the commercial business, or by a reduction in some way, not now apparent, of the cost of operation."

Electrical Engineering Laboratories Dedicated at Worcester Polytechnic Institute.

The new electrical engineering laboratories of the Worcester Polytechnic Institute were dedicated on commencement day, June 13, in the presence of Governor Guild, of Massachusetts, members of the board of trustees, faculty, alumni, students and invited guests. The graduation exercises were held in the main experimental room of the building, and in addition to the governor, one of the speakers of the occasion was Mr. Charles F. Scott, of Pittsburg, consulting engineer of the Westinghouse Electric & Manufacturing Company.

Mr. Scott outlined in a broad way the economic changes due to the larger utilization of the forces of nature and emphasized the manufacture of power as peculiarly the field of the engineer. He sketched the increased output due to the extensive use of power, and characterized electricity as a factor in civilization that is cleaner, more economical and more desirable than all other forms of power, especially in its ability to remove limitations and open up new fields of development. Factory installations were cited, one of which originally contained about 50 small steam engines of 15 or 20 horse-power at various points; the electric drive was substituted, and a 500-hp steam turbine outfit in a central power house removed the previous limitations as to economy and flexibility.

VIEW OF ELECTRICAL ENGINEERING BUILDING, WORCESTER POLYTECHNIC INSTITUTE.

Progress in prime movers was touched upon, and the speaker stated that while 7000-hp reciprocating units with 50 per cent overload capacity had been built, the reciprocating engine in large sizes is doomed by the steam turbine. We can look forward to turbine outputs of 15,000 to 20,000 horse-power with confidence. The gas engine has its field, but is handicapped by small overload capacity and little flexibility. Mention was made of the Indiana plant of the U. S. Steel Corporation where no steam power was installed; here motors of some

6000 horse-power will drive the rolling equipment, being reversed in three or four seconds, and operated by gas engine-driven generators of inherently constant speed without overload capacity. The achievements of electrochemistry and telephony were outlined, the telephone being defined as the high speed tool of our general life. Better methods of doing things characterize the work of the electrical engineer on every hand.

The development of hydro-electric power, its remote sources of generation, flexibility of transmission and ease of transformation were pointed out, with the importance of its low cost to the consumer. Mr. Scott then took up the limitations of the steam locomotive and outlined the advantages of electricity in heavy traction service. The steam locomotive cannot be made wider on account of the gauge limits, nor higher on account of tunnel and bridge clearances. It cannot well be made much larger because of the limitations of the length of rigid wheel base, and it cannot wisely be made much heavier. The pressure now exerted on a rail by some of the large locomotive drivers comes close to 225,000 lbs. per square inch, which is nearly the limit. Steaming capacity and reciprocating parts also set limits to the development of the steam locomotive. The freedom of the electric locomotive from nearly all these drawbacks was taken up in detail, together with the higher economy of the latter for the same service and its increased capacity for service.

The increased output at reduced cost possible and realized from electrically driven machine tools were then considered, and the stimulating influence of electrical development upon engineering education was emphasized. Direct and practical results are required under modern methods of teaching. After mentioning the post-graduate shop courses of the Westinghouse Company, which will employ about 500 young engineers this summer, Mr. Scott closed with a strong plea for breadth of outlook on the part of the graduating class. Fifty-nine men were graduated, 23 being electrical engineers. It is expected that the new laboratories will be completely equipped by early fall.

CURRENT NEWS AND NOTES.

OCCUPYING HIGHWAYS.—The governor of Pennsylvania has signed the bill which requires that gas, electric light or water companies, before entering on or occupying any street or highway in the state shall apply to the local authorities for their consent before they may make such entrance.

MR. B. J. ARNOLD delivered the Commencement address before Armour Institute on June 13, and the same day received from that institution the degree of Doctor of Science. With the exception of a stiffness that promises to wear away, Mr. Arnold has recovered from the accident which severed his tongue.

A NEW MASSACHUSETTS BOARD.—Gov. Guild, of Massachusetts, has signed a resolution providing for a commission of commerce and industry. The commission will consist of five persons, to be appointed by the governor, and representing the law, transportation, manufacturing, capital and labor interests of the State, to make investigations and suggest to the next Legislature measures for increasing the prosperity of Massachusetts.

THREE-PHASE vs. *ONE-PHASE TRANSFORMERS.*—Through an error in transcribing our review of the high-tension transmission meeting of the A. I. E. E. at Chicago, Mr. A. H. Pikler was reported on page 1221 of our issue for June 15 as having stated that manufacturers can make larger profits on three-phase transformers, when, as a matter of fact, Mr. Pikler had stated that "the manufacturers can make larger profits on one-phase transformers."

ENGINEERS AS COMMISSIONERS.—At its annual meeting, June 10, the New York Electrical Society adopted the following resolutions: "Whereas, The Legislature of New York State has enacted the public utilities bill providing for the appointment by the Governor of two commissions consisting of five men each, and, Whereas, these two commissions are to have general direction and charge of the electric lighting, electric railway, gas, steam railway and other public utilities including practically all the large engineering enterprises within the state, and, Whereas, many of the questions to be settled by said commissions are technical in character, the responsibility for the decision of which should properly be borne by commissioners and not by hired experts, Therefore, be it Resolved, that in the opinion of this society, the engineering profession should be given representation on each of the state commissions by the appointment of two or more commissioners who shall be technically trained men with business ability, and, Further Resolved, that the secretary be and hereby is instructed to send copy of this resolution to the Governor of the state, the Hon. Charles E. Hughes." It is understood that among the names of engineers submitted to the Governor are those of Dr. Louis Duncan and Messrs. Frank J. Sprague, Henry Floy and Charles W. Price.

EUROPEAN TELEPHONY.—The New York *Sun* devotes a whole page to reports on the practical conditions of telephony in Europe. The introduction says: "The number of new telephones installed in the United States last year far exceeded the total number in use in Great Britain. The use of the telephone in America is ten times greater than in Europe, in proportion to population. This amazing preponderance is not easily acounted for on first inquiry. The flattering explanation which first suggests itself is that this is the measure of American alertness in utilizing quickly every new facility which science puts at the disposal of mankind. But this assumption, while it contains a germ of truth, would be seriously unjust to the people of the Old World. Englishmen and Germans and Frenchmen most of all have been as prompt as the Americans to develop the still newer automobile industry. The telephone is now more than thirty years old. Why is it not in almost universal use on this side of the Atlantic, as it is on the other? The answer is to be found in the practical working of one of those principles of political economy or statecraft, and it furnishes one of the most striking object lessons which modern history can furnish. It is public authority, the bureaucracy, the state, which has hampered and crippled the introduction of this great invention, just as it hampers and cripples the development of every industry which it touches."

INDIANA NATURAL GAS.—The Federal Court at Indianapolis has entered decrees providing for the sale of the properties of the Logansport & Wabash Valley Gas Company, the Lafayette Gas Company, the Indiana Natural & Illuminating Gas Company, the Ohio & Indiana Gas Company and the Ohio & Indiana Consolidated Natural & Illuminating Gas Company, provided these companies do not pay their indebtedness at once. The decrees are in favor of the Central Trust Company, of New York, which holds the mortgages on the property, as trustee, to secure the bond issues. The decree provides for foreclosure in case of default in payment. The amount due from the several companies is several million dollars. It is quite likely that several of these plants will be bid in for the purpose of utilizing the mains for the distribution of artificial gas. The passing of these and other companies is the last phase of the wonderful natural gas period in Indiana. The oldest natural gas company is that of the Citizens' Gas Company, of Elwood. This company has been furnishing natural gas continuously since August, 1887, but at last announces that the plant is for sale and gas will not be furnished after Nov. 1. The managers say the field is exhausted and that its 29 wells can no longer be depended upon. At one time managers of electric light stations in this field saw nothing but ruin ahead of them owing to the absurdly cheap price at which natural gas was put in competition. These electric companies are "coming to their own" again.

NEW YORK TELEPHONY.—At a meetling last week seven of the eight members of the New York Board of Estimate, sitting as a committee of the whole, voted to report back to the Board of Estimate in favor of granting a franchise to the Atlantic Telephone Company, which is seeking to establish a 5-cent telephone service. The franchise can only be granted by the Board of Estimate itself after suitable terms have been agreed upon between the city and the representatives of the company. But the action of practically the entire membership of the board is regarded as a virtual rejection of the offer which the New York Telephone Company made to the city for an exclusive franchise. Attorneys for the latter company were present and made a determined fight to prevent action being taken on the Atlantic Company's offer.

MERGER A MONOPOLY.—It has been hoped that the long and bitter fight at Lockport, N. Y., would soon be settled. Attorney-General Jackson has declared, however, that he does not favor the proposed consolidation of the lighting and power interests of Lockport and declares that such a merger might be considered a violation of the section of the corporation law which seeks to prohibit monopolies in restraint of trade. Last week, the hearing before the Commission of Gas and Electricity on the application of the Lockport Light, Heat & Power Company, of Lockport, Niagara County, for a certificate of authority to transact business and for consent to issue $600,000 capital stock and $600,000 bonds, and in connection therewith on the application of the Lockport Gas & Electric Light Company and the Economy Light, Fuel & Power Company for consent to transfer their respective properties and franchises to the Lockport Light, Heat & Power Company, was adjourned to June 19.

THE TELEGRAPH STRIKE long threatened and impending has not come off yet. Meantime, President Roosevelt has referred to Commissioner of Labor Charles P. Neill, without comment, the various appeals which have been made to him by wire and mail to intervene to prevent the threatened telegraphers' strike. The position is taken that no emergency exists, such as obtained at the time the President intervened in the anthracite coal strike, but, on the contrary, the situation presented is one where action by the government, if taken at all, may properly be initiated and directed by the bureau of labor. Attention is also called to the fact that Mr. Neill has, on his own motion, acted with more or less success in several recent strikes simply by making an investigation and bringing to light the salient facts in the controversies, his reports being the basis on which a settlement was later reached. Whether he will feel justified in pursuing the same course in the present instance is not conjectured on here, as the President has given Mr. Neill no intimation of any kind. The executive committee of the Commercial Telegraphers' Union of America held a brief session last Sunday, in New York City, after which Secretary Treasurer Wesley Russell took the train for Chicago, where he will confer with the Chicago local regarding the complaints against the Western Union and Postal Telegraph companies. If trouble occurs it is expected first in Chicago.

FOREST TELEPHONY.—Plans have been made by the government forest service for the further construction of telephone lines in the national forests of Oregon, Idaho, New Mexico, Colorado and several other states. The telephone is playing an important part in the administration of the national forests and already much success has been made in the installation of lines in California, Montana, Washington, Arizona and other sections where it is needed most. Supervisors and rangers have found the telephone of great assistance in their work and they will welcome its increasing use. Without the telephone, communication between the various forest officers is had only through the mails and sometimes there is a delay of several days or more before an order can be executed. The telephone will not only facilitate the work greatly, but will bring about better co-operation between the men working in the forests and will play an important part in extinguishing forest fires before they have gained headway. It is possible to construct the lines in the national forests at a very low cost, owing to the fact that material for poles and cross-arms are right on the ground. The methods of construction are simple and usually the standing trees are docked and used for poles. The lines are so planned that they usually follow a road or trail. Contracts have been made for enough wire and other materials to construct 3000 miles of lines for the national forests. This material will be distributed from Salt Lake and Denver and will be used for lines already authorized and those to be started later in the year.

SIGNS FOR CHURCHES.—Mr. R. S. Hale, general agent for the Boston Edison system, has the following letter in a recent issue of the *Electrical Times*, of London: "I note in your recent issue a slightly sarcastic reference to the use of an electric sign for a church in Boston, U. S. A. I trust that we are equally as considerate of the dignity of the church as in any other country, but it seems to me at least that a proper and dignified use of electricity is entirely appropriate to church work. A church is always designed to show its churchly character. Outside the church (by church, I mean the church building and not the ecclesiastical organization) are often placed signs and notices calling the attention of the people. These signs can be read by daylight. To place lights so that these notices may be illuminated at night is certainly proper. To make the signs themselves of lights is only carrying the method a logical step further and is in no wise a change in principle. So long as the principles are lived up to the question of details is merely the question of what people are accustomed to. I always remember when Moody and Sankey began their evangelizing work that one of them said that he was not going to let the Devil have all the good tunes. Why should a church give up methods of welcoming people to its doors at night, merely because secular organizations have used the same method? So far as the principle goes, they might as well refuse to put up notices at all because secular organizations also put up notices outside their doors." The editor of the journal declines to discuss the topic, and also refrains from reference to church bells.

TELEPHONY IN BOSTON.—The Boston *Herald* is the authority for the following: "Five million dollars has been guaranteed by E. H. Harriman, so the promoters of the Metropolitan Home Telephone Company, of this city, say, to insure the installation of an independent telephone system in Boston. The promoters have held many conferences recently, but nothing definite has been accomplished in the line of securing real estate for the central exchange. Plans have been drawn and estimates have been procured from contractors to ascertain the probable cost of headquarters and the laying of conduits. Some of the promoters strongly favor the automatic system. Engineers are at present making tests of all the various telephone systems with the view of selecting the most practical. In a very few weeks, it is probable the new company will decide upon its system and the work of installing an exchange of about 1000 subscribers will be begun. After all the plans are drawn and the contracts awarded the application for permits for opening the different streets will be made. It is anticipated that a bitter fight will be made upon the application for these permits for the opening of these streets and the promoters of the independent company are prepared to make a determined fight for what they regard as their legal rights, now that they have a franchise from the Board of Aldermen for certain streets of the city. The election of the officers of the company will be attended to probably some time late in the summer or early in the fall, and it is declared to be not improbable that Bernard Wolf will be the choice for president. Alfred S. Hayes, the lawyer who managed the fight which resulted in the company's securing a franchise from the city government, is expected to be chosen consulting attorney. The operating plant is expected to be surely installed before winter."

TIME BY WIRELESS.—It is announced from Canada that in order that ships at sea which are equipped with wireless apparatus may obtain the exact time for comparison with chronometers and thus determine accurately their longitude the Dominion Government has installed a device at Camperdown, the government station at the entrance to Halifax Harbor, Halifax, Nova Scotia, to transmit automatically by wireless the exact time furnished by the Government Observatory at St. John, N. B. The time signals will be sent each week day morning.

ILLEGAL MUNICIPAL PLANT.—At Trenton, N. J., on June 10, in the proceedings instituted by Herbert Lightpipe against the city of Orange, Justice Pitney announced that the Supreme Court set aside the resolutions of Orange awarding certain contracts to the Crocker-Wheeler Company and the Western Electric Company for the construction of a municipal lighting plant. These aggregate about $70,000. The proceedings were attacked on various grounds, among them that the city had no authority to maintain a lighting plant. It is not known what further move can or will be taken in the matter.

FARES IN LONDON.—According to advices from London of June 11, an agreement has been reached by all the underground and electric railways in London for an advance in fares on July 1, and the motor bus companies are expected to follow suit. In explanation of the advance, it is alleged that the transportation companies are losing money at the present rates. It is said that the persons who are now paying 4 cents each for their rides will notice the advance more than any other class of passengers, all the railroads concerned in the agreement having undertaken to advance as many as possible of their 4-cent fares.

THE UTILITIES LAW.—It is reported by the New York *Sun* that one of the members of the Rapid Transit Commission has said that the advisability of testing the constitutionality of the public utilities law is being considered. If the legality of the bill is attacked a taxpayers' suit will be brought and the contention will be made that as the new commission is to be appointed by the Governor and not by the elected head of the city government the local taxpayers, whose money can be spent for new subways by the commission, have no direct representation on the board and the act is therefore illegal. If it is decided to fight the law, the suit will be begun when the new commission applies to the Sinking Fund Commission for an appropriation, and an injunction will be asked for to restrain the Sinking Fund Commission from authorizing the board to rent offices at the expense of the city.

AN ELECTRIC FAN RIVAL.—U. S. Consul E. H. Dennison writes that a German firm has recently introduced into Bombay a portable fan, which is propelled by a hot-air engine and which is destined to have a large sale throughout India. "Owing to the intense heat which prevails in this country during most of the year, fans of some kind are a necessity to the comfort of Europeans, and their offices, shops and residences are all equipped with the old-fashioned swinging screens known as 'punkahs,' which consist of a piece of cloth or matting stretched over a rectangular frame hung from the ceiling and kept in motion by a servant at the end of a cord. Wherever electricity is introduced these are generally superseded by electric ceiling fans. The natural field for the hot-air fan engine would be in localities where there is no electric power, but it has been found that it can compete with the electric fan in the latter's own field, owing to the extreme cheapness of the cost of its running, which is about one-fifth of that of the electric fan. The fan is propelled by a hot-air engine, the heat being generated by a kerosene lamp which holds about one quart of oil, sufficient to keep the fan running for over 24 hours. To the lamp is attached a small glass chimney which fits into a larger metal chimney connected with the engine. Upon the top of the engine is hung the fan, similar in shape and size to the ordinary electric fan, whose speed is governed by the size of the flame; that is, to reduce the speed the flame is turned down, and to increase it the flame is turned up. The whole outfit weighs about 30 lbs., and sets upon a small stand, raising the level of the fan proper to that of an ordinary desk. It is fitted with handles, and can be easily moved to any portion of the room or house desired." These fans, which cost $62 apiece, seem to be very good appliances for distributing their own heat.

THE RECORD OF ACCIDENTS.—According to figures compiled by the statistician of the Chicago *Tribune*, though the first half of 1907 has not passed, its record of casualties already exceeds the total of 1906. There have been 38 railroad accidents of more than the ordinary magnitude, in which 273 persons have been killed and 925 injured. Twenty-three steamers have been wrecked, involving the loss of 902 lives. There have been 13 mine accidents in which 355 persons have perished. These casualties have been due to human negligence or ignorance in large part, but nature has been destructive also. Tidal waves have swept away 2240, earthquakes 5100, hurricanes 530, but cyclones thus far have been comparatively merciful, unless there shall prove to have been great loss of life by the one at Kurrachi, India, last week. In other cyclones about 70 have been killed. The cloud has a silver lining, however. The total of gifts and bequests in all forms of philanthropy in less than six months of 1907 is larger than the total for the twelve months of 1906, being $108,961,589, as compared with $106,281,083.

CANADIAN POWER SCHEMES.—U. S. Consul H. D. Van Sant, in reporting the rejection by the city authorities of an offer to supply Kingston, Ont., with power from the Trent River, writes as follows giving the reason for such rejection: "The power committee on investigation finds that the best way to generate power in small quantities is by the suction gas producer. It is claimed that power can be generated in Kingston cheaper by coal than it could be brought here from the Trent by the hydro-electric commission. The locomotive industry here finds it could easily afford to generate power from steam, using the surplus steam to heat the buildings. Where the buildings are not to be heated, then the gas producer is cheaper. Industries requiring power are advised to generate it themselves. A horse-power for 10 hours a day could be manufactured for $12.50 a year with gas; that was the greatest length of time any industry in Kingston required power. When running 24 hours a day the electric proposition would be of advantage, but it was not adapted for Kingston's present use."

ELECTRICITY IN THE YUKON.—U. S. Vice-Consul G. C. Woodward, of Dawson, reports on the improvements in Yukon Territory as follows: "An important work contemplated in the near future is the construction of a large power house of approximately 1000 horse-power near the western boundary, on the Yukon River, some 50 miles below Dawson, for the purpose of furnishing electrical power to dredges on the Fortymile Creek and its tributaries in Alaska and the Fortymile and Klondike Rivers in the Yukon Territory. The company has a power house in Dawson and furnishes this city and Grand Forks with electric light, and Dawson with water for household purposes and a hydrant system for fire purposes. On the completion of the power house at the boundary the company intends doing away with the works at Dawson, other, than to hold it as a reserve in case of accident to the new plant. The fuel used in their present plant is coal taken from the company's mine on Coal Creek, at which place the proposed plant is to be situated, the idea being that it is cheaper to convey electricity than coal. The output of the mine last year amounted to some 8000 tons, the entire output being used by the company in Dawson. This coal landed at Dawson by the company's steamers cost about $12 per ton. With the plant at the mouth of the mine the coal costs about $2 per ton."

Greenville-Carolina Power Company, Greenville, S. C.

BY J. S. VIEHE.

THE system of the Greenville-Carolina Power Company, which supplies the city of Greenville, S. C., and certain mills in the immediate vicinity with power, was put into operation in December, 1906. Greenville, a community of about 30,000 inhabitants, is located among the foothills of the Blue Ridge Mountains in the northwestern part of South Carolina. It is on the main line of the Southern Railway and in the heart of the "Piedmont Section," one of the most prosperous sections of the South. The elevation—1040 feet above sea level, the highest of any city in South Carolina—the surrounding country abounding in unsurpassed cotton fields, a population of energetic, hustling people, all of these features have contributed to make Greenville a thriving manufacturing city. Within and immediately contiguous to the legal city limits are 306,000 spindles. This very considerable market for power is now partly supplied by the lines of the Greenville-Carolina Power Company.

The location of the power house and dam is on the Saluda River at a point about five miles west of Greenville. This river rises in the mountains between North and South Carolina and has a fall above Greenville of six feet per mile. The drainage area is approximately 300 square miles. At the point selected for the location of the dam and power house, the river is about 100 ft. wide, having on the east or power house side, a bluff of ledge 100 ft. high, and on the west side, a gradually sloping hill.

Fig. 2 shows clearly the general arrangement of dam and power house. The dam proper is 275 ft. long, built on a curve of large radius, and is 47 ft. wide at the base and 9 ft. at the top. The up-stream side is vertical, the down-stream side being concave, with a long toe to turn the water. The headgate wall 130 ft. in length is a continuation of the dam and joins the solid rock on the east side. This wall forms the north wall of the power house. The abutment dam, headgate wall and foundation piers for power house were built on solid ledge and constructed of concrete with ballast stone interspersed.

POWER HOUSE.

The power house is of brick with concrete floor and tar and gravel roof. It is 84 ft. x 105 ft. with an alcove 14½ ft x 40 ft. It is thoroughly modern in all details, well lighted, equipped for the care and operation of machines and answers admirably the purpose for which it was intended. Fig. 1 is interior view of the power house and shows general arrangement of the apparatus.

The wheel equipment was furnished by the S. Morgan Smith Company, of York, Pa., and comprises four units, each having a pair of 33-in. wheels, one unit having a pair of 21-in. wheels and one unit with a 15-in. wheel which is used for driving the main exciter. All of the wheels are of the inward flow type. The large units are controlled by Woodward governors and the 21-in. wheel by a Lombard governor, as it was desired to get close speed regulation when using this machine. The main generating units, direct-connected to the above wheels, are four 600-kw generators and one 200-kw generator, all wound for 13,200 volts 3-phase 60 cycles. These generators are guaranteed to carry 25 per cent overload. From each generator the high-tension wires are carried in ducts by means of lead-covered cables to the respective oil-insulated choke coils seen on each side of the switchboard, and thence to the bus-bar structure immediately behind the switchboard. The bus-bar structure is constructed of concrete and soapstone slabs and affords compartments for all of the high-tension apparatus. The switchboard carries the switch handles for operating the oil switches, ammeters, voltmeters and all low-tension apparatus.

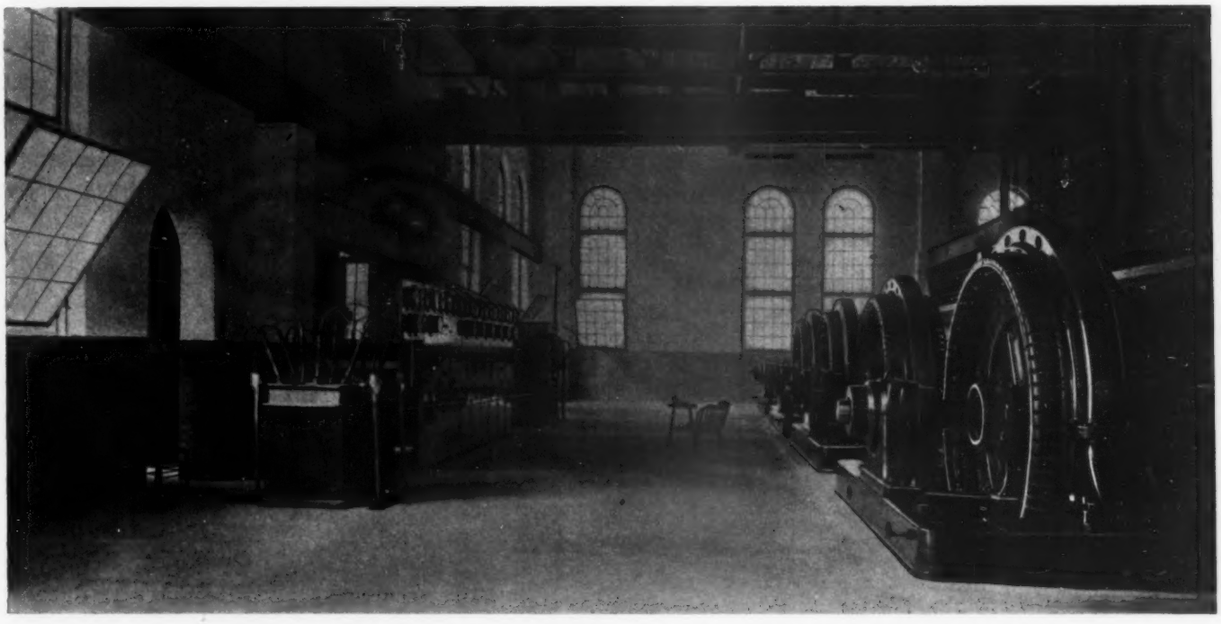


FIG. 1.—VIEW OF INTERIOR OF GREENVILLE-CAROLINA POWER COMPANY'S STATION.

The main exciter used in the regular operation of the station, has a capacity of 70 kilowatts, 125 volts, and is direct-connected to an independent wheel in order to obviate the trouble often experienced, of having the exciter affected by load conditions in the main generating system. There are three other exciters, two of 30 kilowatts and one of 12½ kilowatts, all generating at 125 volts and all belted to the shafts of the main generators. The two 30-kw exciters are so arranged that they can be belted to either of the two 600-kw generators. The 12½-kw exciter is belted to the 200-kw generator, thus forming a unit which is used alone to carry the night load, which load consists of the lighting of the town of Greenville and the running of motors. All wires from these exciters are carried in ducts imbedded in the concrete floor to the rear of the switchboard, and from the switchboard in the same character of ducts to the generators.

The load of this power house consists largely of cotton-mill load, and there is also a load in Greenville which consists of street railway, lighting and small motor load. The mill load, about 1500 hp, is a very steady load and is used from 6 a. m. until 7 p. m. The traction load is extremely variable and has

a maximum of about 600 kilowatts continuing from 6 a. m. until 11 p. m. It will be noted that in the evening, the only load on the power house is a combination of the lighting and traction load, making a somewhat variable load, but one which is taken care of very satisfactorily by the apparatus in the power house. After midnight, the load is very light, consisting only of small lighting and power load in the city of Greenville. A Tirrall regulator is used in conjunction with the generators, in order to keep the voltage constant. All the apparatus for the power house was furnished and installed by the Westinghouse Electric and Manufacturing Company.

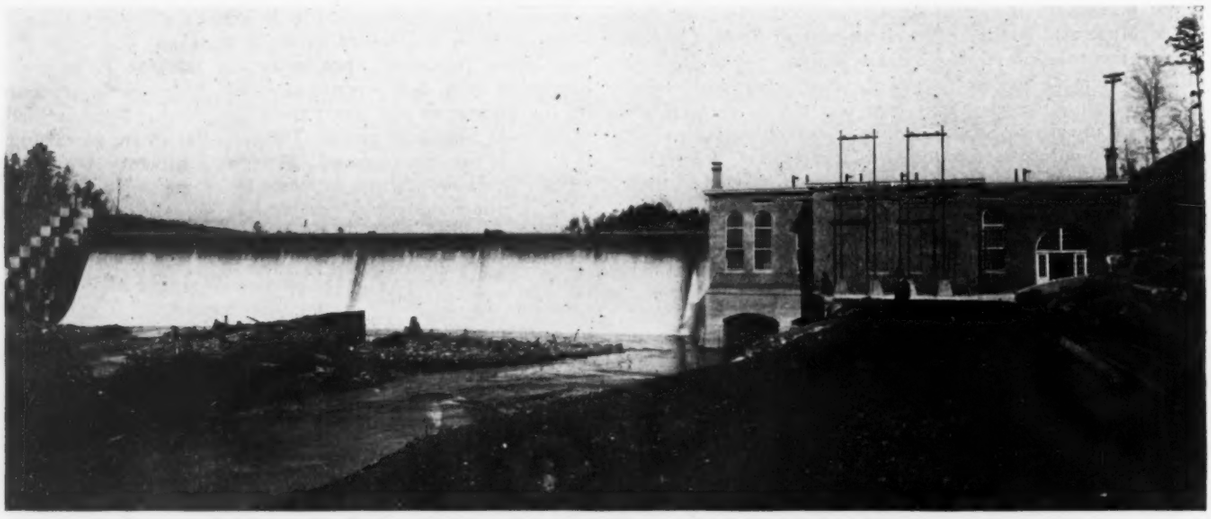


Fig. 2.—Exterior View of Greenville-Carolina Power Company's Plant.

The operation of the station is in the hands of a superintendent and three assistants, who divide the shifts in such a way that there are two men in the station at all times. The night work is so arranged that each man has his portion, thus equalizing the hardships and giving every man experience in the station at all times.

On the hill to the east of the power house, a comfortably furnished six-room cottage is provided. With telephone connection, electric lamps and water works, this house affords a pleasant home for the men. These four men together with a lineman, who looks after trouble on the lines and building extensions of same, constitute the regular operating force.

TRANSMISSION LINES.

To insure the delivery of power by the transmission line, it was considered advisable to run two three-phase transmission lines on the same poles for the entire length of the line. It was therefore necessary in the various sub-stations, also in the power house, to provide switches by means of which the apparatus can be connected to either or both of the lines. All of the fixtures for this line are of heavy stock and were chosen with special care to getting good material. The standard size of pole is 35 ft. long with 8-in. top and is of Southern white cedar or juniper. The cross-arms are 3¾ in. by 5½ in., of longleaf Southern pine and were creosoted after being placed in position. Each cross-arm is held firmly by means of two ⅝-in. bolts passing entirely through the pole, and by braces of angle iron thoroughly galvanized and fastened to the cross-arms and poles by means of galvanized lag screws. The pin was furnished by the Locke Insulator Manufacturing Company, and has a through bolt with oak top. The insulators were furnished by the Lima Insulator Company.

The standard spacing of the poles is 110 ft., but it was found is special places necessary to increase this spacing or decrease it, as the conditions required. The line was graded by means of a profile and different lengths of poles used to avoid upward strain on the insulators. At angles in the line, poles carrying double cross arms were used, and where the angle was quite large, a group of poles was used with cross arms extending between them and transmission wires carried around the insulators, thus reducing the strain on the insulators to a small amount. In crossing telephone or telegraph wires, where it was

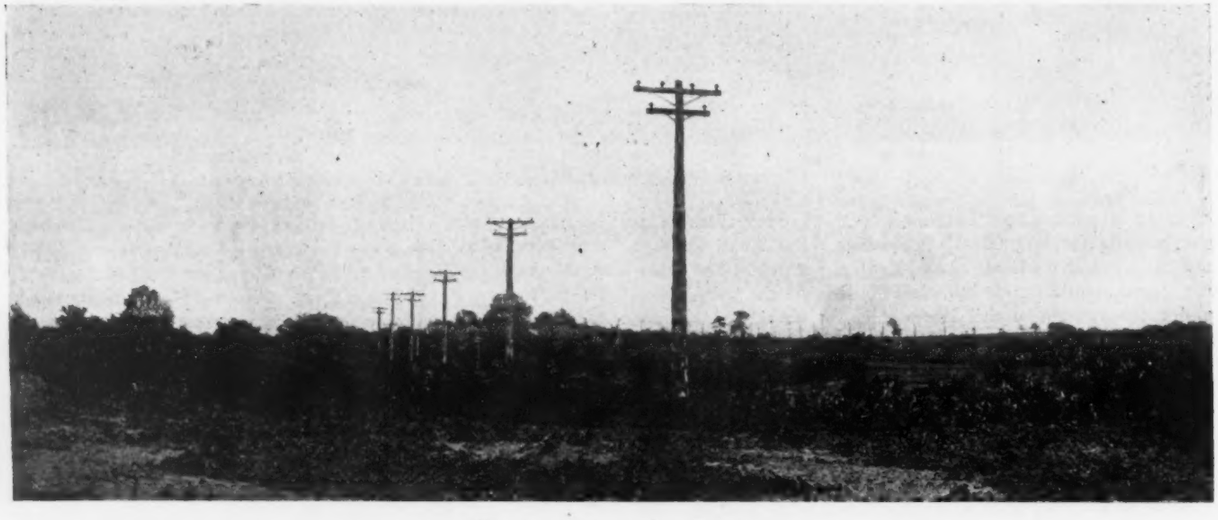


Fig. 3.—View of Pole Line.

possible to do so high poles and short spans were used, so that in case a wire should break in this span, it would not be long enough to hang down and touch the protected wire. At crossings where it was impossible to do this, a cradle was used which was made by carrying four steel cables between the poles and fastening across this at intervals of about four feet, pieces of

FIG. 4.—CITY SUB-STATION FROM WHICH THE GREENVILLE RAILWAY AND LIGHTING COMPANY IS SUPPLIED.

¼-in. iron. With this method, it was considered that if the wire should fall, this cradle would catch it and hold it from coming in contact with the telephone wires. These cradles were permanently grounded by means of a copper plate buried in the ground near one of the poles. All of the wire used on this line is bare copper; that from the power house to the Brandon Mills, a distance of about three miles, is No. 2 and that from the Brandon Mills to the sub-station in Greenville is No. 3. The total length of the line is 5.8 miles.

SUB-STATIONS.

There are at present three main points at which power is transformed and delivered to customers or distributing circuits:

FIG. 5.—INTERIOR VIEW OF CITY SUB-STATION.

(a) The Brandon Mills, where approximately 1500 hp is used.

(b) The Carolina Mills, with a consumption of about 200 hp.

(c) The sub-station in the city of Greenville, with a capacity of 1155 kilowatts.

All of these buildings are of brick with concrete floor and tar and gravel roof, and in all provision is made for hoisting transformers out of cases to facilitate repairs.

The sub-station at Brandon Mills has three 500-kw oil-cooled transformers, reducing from 13,000 volts, three-phase, to 575 volts, three-phase, which voltage is carried to the mill and used in driving cotton mill machinery. The transformers are connected to the high-tension lines by means of fused circuit-breakers and double-throw link switches, which permit connecting the transformers to either or both of the lines. A three-phase oil insulated choke coil is interposed in the lines between the lightning arresters and transformers, for the protection of the latter. The low-tension wires, which are quite heavy, are carried from the transformers directly to the ceiling and then through the wall and over to the mill, a distance of about 100 ft. The measurement of energy is made in the low-tension wiring near the transformers, by means of a watt-hour meter. All of the apparatus for the station was furnished by the Westinghouse Electric & Manufacturing Company.

The sub-station at Carolina Mills has three 100-kw transformers. These transformers are connected to the high-tension line by means of an oil switch. The secondary wires carrying 575 volts, three-phase, are in ducts beneath the concrete floor and run to the low-tension switch, from where they run to the ceiling and thence to the mill. This equipment of transformers, lighting arresters, switches, etc., was furnished by the General Electric Company, but installed by the Power Company.

The sub-station in Greenville is of the same general type as the above, but is much larger, being 22 x 50 ft. in plan. It is lo-

FIG. 6.—CAROLINA SUB-STATION

cated on a piece of property adjoining the power house of the Greenville Gas and Electric Light and Power Company, as this company uses the power for operating its railway system and lighting system, and its load forms a considerable and important part of the output of this sub-station. Both high-tension lines are brought in at one end of the buildings and after passing through independent three-phase oil insulated choke coils, are carried to the high-tension bus, which extends the width of the building. Immediately in front of the bus are the fused circuit breakers, and from them the wires are carried on the ceiling to the transformers located along the two sides of the building. The equipment for the railway service consists of three 135-kw transformers with a secondary voltage of 420. For furnishing the lighting circuit and small motors, the sub-station contains two 150-kw transformers supplying 2200 volts, two phase. The wires for both of these services are carried in multiduct conduit to the power house of the consumer, a distance of about 150 ft., the measurement of energy being made by watt-hour meters at the point where the wires enter the building. The cables which carry power for operating the railway, are connected to two 300-kw six-phase 60-cycle G. E. rotary converters and the same feeders supply an induction motor driving a direct-current arc machine. The 2200-volt

circuit supplies directly the distributing mains for lighting and small power purposes in the city of Greenville.

This consumer uses the power exclusively in the operation of its systems and it has been found to be very satisfactory indeed, no accidents to machinery or other serious troubles having occurred to bring into question the reliability of the power. The demand of this service has been increasing continually, but the growth has been provided for by installing sufficient capacity in transformers and allowing space in the sub-station for the installation of additional transformers. Besides the above, there are also located in the sub-station three 150-kw transformers supplying 2200 volts, three-phase, distributed by the Power Company to loads in the city such as machine shops, small mills, etc.

As is usually the case in a community where electricity is new and untried, it is being found that the sale of energy is very simple after operation of the system is begun, and even now negotiations are under way which will very materially increase the revenue of the company.

An item of importance in connection with this development is the fact that there is no ice whatever in the Saluda River at any time. The simplicity of this installation is very well illustrated by the fact that the entire pay roll of the company, outside of the president and treasurer, includes only six men.

The construction of the plant was carried out by the Federal Construction Company, of Boston, with Mr. A. G. Furman, vice-president of this company and president of the Greenville-Carolina Power Company and Mr. J. S. Viehe, electrical engineer. Messrs. Lockwood, Greene & Co., of Boston, were the engineers and furnished general supervision over the construction work.

On the Determination of the Mean Horizontal Intensity of Incandescent Lamps.

By Edward P. Hyde and F. E. Cady.

INTRODUCTION.

In a paper "On the Determination of the Mean Horizontal Intensity of Incandescent Lamps by the Rotating Lamp Method," published several months ago in abstract in the Electrical World[1], and subsequently in full in the *Bulletin* of the Bureau of Standards,[2] the authors after reviewing briefly the various methods employed in the determination of mean horizontal intensity, described an investigation, undertaken at the Bureau of Standards, of the possible errors of the rotating lamp method. This method is the one in almost universal use in the United States. Recently another paper[3] on the same subject has been published by Uppenborn in Munich. Inasmuch as the results given in the latter paper are at variance with those obtained at the Bureau of Standards, and have, moreover, been quoted in the United States as discrediting the determination of mean horizontal intensity by the convenient method of rotating the lamp about its axis of figure, it seemed desirable to present some further data obtained at the Bureau, and also to call attention to several points of difference in the two methods employed to study the accuracy of the rotating lamp method.

According to the results obtained previously at the Bureau in the study of this method, two possible sources of error were found when the lamp was rotated, one due to a distortion of the filament produced by centrifugal forces, and one due to the flickering nature of the illumination of the photometer screen, produced primarily by the non-uniformity of the horizontal distribution curve of the lamp. Of these two effects the first was found to be quite small at moderate speeds of rotation for all types of filaments examined, the maximum error at 500 or 600 r. p. m. being only about 1 per cent.

The error due to flicker, however, was found to be quite large for lamps of certain types in which the horizontal distribution curves deviate greatly from a circle. Moreover, the error was found to be largely a function of the individual, some observers reading a flickering light too high and others too low. Except, however, for a few types of lamps (of the number examined) in which the flicker is very annoying, the combined error due to both bending and flicker is probably not much over 1 per cent, particularly if the speed of rotation is increased to 300 or 400 r. p. m. By the use of a single auxiliary mirror as described in the original paper, the flicker pertaining to all types of filaments is greatly reduced, so that even those lamps with the most irregular horizontal distribution curves can be photometered with accuracy at a speed of only 200 or 300 r. p. m., at which the effect of bending is negligible for all types of lamps studied.

In the investigation at the Bureau a substitution method was employed, which did not necessitate a determination of the actual candle-power of the lamp studied. Any change in candle-power, due either to the bending of the filament or to the flicker, could be detected and measured separately. For the nine different types of lamps investigated, as described and illustrated in the detailed paper referred to above, the greatest change in mean horizontal candle-power due to bending at a speed of 550 r. p. m. was found to be only about 1 per cent. For most of the types of filaments the effect of bending was to decrease the mean horizontal intensity, but for one type the effect was to increase it by about 1 per cent.

In Uppenborn's investigation the lamps were measured for actual mean horizontal candle-power, by taking the mean of 36 readings made every 10 degrees in the horizontal plane. The values obtained in this way were taken as the true values, and a comparison of the candle-power values obtained by other methods with these standard values gave the errors incident to the several methods studied.

In this way eight lamps of different sizes, types and voltages were measured for mean horizontal candle-power, first by the point-to-point method, and subsequently by the rotating lamp method. A comparison of the results indicated that the values obtained by the rotating lamp method were uniformly too low, the amount of the error ranging from 3.3 to 9.9 per cent. Uppenborn attributes the errors to the distortion of the filament on rotation, but since the experiments at the Bureau had shown in no case an error much over 1 per cent due to this cause, it seemed desirable to make some further experiments by a different method, and using lamps of other types than those previously investigated. The differences in the results obtained at the two laboratories could not have been due to differences in speed used, for in the experiments at the Bureau various speeds were employed up to 550 or 600 r. p. m., whereas in Uppenborn's work, although no definite statement is made of the speed at which the results quoted above were obtained, it is very probable that no greater speed than 450 or 500 r. p. m. was employed, since this is the limiting speed stated in another part of the paper.

METHOD AND RESULTS OF RECENT EXPERIMENTS.

Before conducting experiments upon types of filaments differing from those investigated previously a few measurements were made on some of the same types of filaments, in order to check the results obtained by the former method using the rotating mirrors with those obtained by the new method. In this new method the lamp was placed in a universal lamp-holder which could be set at different angles, but which also could be rotated. In general, readings were made first with the lamp spinning, then at every 10 degrees in the horizontal plane with the lamp at rest, and again with the lamp spinning. The speed was then gradually increased, in some experiments until the filament touched the bulb. This way of comparing the point-to-point method with the rotating lamp method was chosen as being somewhat similar to that employed by Uppenborn, with the advantage that being a substitution method it does not involve the actual calibration of the comparison lamp such as is done in Uppenborn's experiments.

The first lamp studied was a 110-volt 16-cp oval anchored

[1] Electrical World, Nov. 17, 1906; p. 956.
[2] *Bulletin* of the Bureau of Standards, Vol. 2, No. 3; p. 415.
[3] *Electrotechnische Zeitschrift*, pp. 139-168, Feb. 14 and 21, 1907.

filament lamp (Fig. 1, No. 1). In expressing the results of this, as of subsequent experiments, since only relative values are desired the convenient method will be used of adopting an arbitrary unit such that the intensity under some one condition will be take as unity, and then all the other values will be expressed in terms of this unit. In this way the percentage changes will be evident immediately.

The lamp was first rotated at about 420 r. p. m. and readings were taken. Then measurements were made every 10 degrees in the horizontal plane with the lamp stationary, and finally the lamp was rotated again at 420 r. p. m. If we call the first

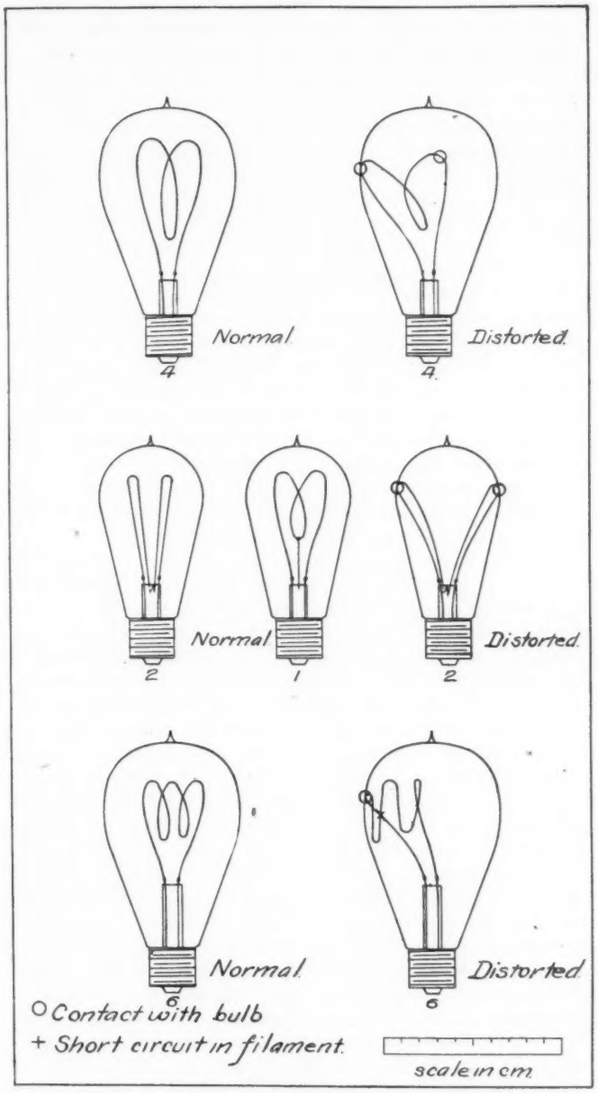


FIG. 1.—TYPES OF FILAMENTS USED IN EXPERIMENTS.

rotating value 1.000, then the value of mean horizontal intensity obtained by the point-to-point method is 1.002, and the value found on subsequent rotation 0.999. In other words, the results obtained by the two methods, the speed of rotation being 420 r. p. m., agree to within 0.2 or 0.3 per cent, which is within the range of experimental error.

Since in this type of lamp the filament is well supported one would not expect as large errors as for some other types, such as the double filament lamp (Fig. 1, No. 2). In this type of lamp, which was next studied, the filament consists of two long, slender loops, entirely unsupported except at the leading-in wires. Denoting by 1.000 the value of mean horizontal candle-power obtained at the beginning at a speed of 350 r. p. m., the value found by the point-to-point method every 10 degrees is 1.005, and the value obtained at the end at a speed of 350 r. p. m. is 0.999. This decrease of 0.5 per cent at a speed of 350 r. p. m. is in very good agreement with that obtained in the previous investigation using the rotating mirror method. The mean of a number of determinations using this method indicated a decrease of 0.9 per cent at a speed of 500 or 600 r. p. m.

Another lamp of the double filament type gave the following results: Mean horizontal intensity at 180 r. p. m., 1.000 at the beginning of the set of measurements, 1.003 in the middle of the set, and 0.998 at the end; by the point-to-point method 1.002, or an average decrease of 0.2 per cent, which also agrees with the values previously obtained for this type of lamp.

Having shown now that the error at a speed of 180 r. p. m. for this type of filament is negligibly small, the two lamps were mounted successively in the rotator and the speed was increased until the filaments touched the bulb, in order to see how large a decrease in mean horizontal intensity could be obtained with this type of lamp, and what the speed must be in order to accomplish this maximum reduction. The results are given in Table I. In the first column are given the different speeds used, in the second column the values of mean horizontal intensity in terms of an arbitrary unit, in the third column the currents under the different conditions, and in the fourth column brief explanatory notes. Usually when the filament was forced against the bulb it sealed itself to the glass (Fig. 1, No. 2, distorted) and had to be shaken loose after stopping the lamp.

TABLE I.

VALUES OF MEAN HORIZONTAL INTENSITY OF DOUBLE FILAMENT LAMPS AT DIFFERENT SPEEDS OF ROTATION.

Speed.	Relative Intensity.	Current.	Remarks.
		LAMP NO. 2.	
180 r. p. m	1.000	0.5232	
400 "	0.990	0.5232_5	
750 "	0.961	0.5237_5	Both loops touching bulb.
180 "	0.997	0.5231	Loops shaken loose. Filament has [a set.
400 "	0.988	0.5231	
470 "	0.986	0.5231	
200 "	0.999	0.5231	
			(Speed gradually increased with the following results:)
.....	0.985	.....	Just before either loop touched bulb.
.....	0.978	0.5232	One loop touching bulb.
.....	0.966	0.5232_5	Both loops touching bulb.
			(Lamp stopped. Loops shaken loose from bulb and cycle repeated.)
.....	0.986	0.5231_5	Just before either loop touched bulb.
.....	0.981	0.5231_5	One loop touching bulb
.....	0.949	0.5233_5	Both loops touching bulb.
.....	0.995	0.5231	Both loops shaken loose.
		LAMP NO. 3.	
200 r. p. m	1.000	0.5217	
510 "	0.985	0.5216_5	
725 "	0.964	0.5217_5	One loop touching bulb
180 "	0.995	0.5216_5	Lamp stopped and loop shaken loose.
330 "	0.989	0.5216_5	
500 "	0.989	0.5216	
750 "	0.966	0.5216	One loop touching bulb.
820 "	0.959	.....	Second loop spreading. Possibly touched bulb.
180 "	0.997	0.5216_5	Lamp stopped and loop shaken loose.
400 "	0.992	.....	
180 "	0.997	.....	
500 "	0.991	.....	
775 "	0.971	.....	One loop touching bulb.

An inspection of the table shows that the maximum decrease in mean horizontal intensity obtained under any condition was about 5 per cent, when, at a speed of 750 or 800 r. p. m., the two loops of the filament were each separately touching the bulb, one at one side and one at the other. In no case did the decrease amount to more than 1.5 per cent so long as the filament did not touch the bulb. In order to test this point directly, the two series of readings recorded near the end of the table for lamp No. 2 were made. One observer made the electrical measurements, a second observer read the photometer, and a third observer increased the speed gradually and noticed when the filament touched the bulb. It is seen that as each loop touched, a decrease in candle-power resulted, but it was impossible to say à priori how much the intensity would decrease when the filament touched.

These various results are not surprising when we consider the effect of a contact of the filament with the bulb. On touch-

ing the bulb the filament is cooled, and so a decrease in candle-power is to be expected. Moreover, the amount of the cooling, and consequently the decrease in candle-power, depends upon whether the filament touches in only one point, or whether it lies against the glass for an appreciable part of its length, so that the decrease in candle-power is not always the same when a filament touches the bulb.

Independent evidence of the cooling of the filament and the consequent decrease in candle-power is afforded by a study of the current values. Although a change in voltage of from 100 to 110 volts produced an increase in resistance of only 2 parts in 1000, yet the cooling due to the contact of a small part of the filament with the bulb was sufficient to increase the current appreciably, in one case the change amounting to 1 part in 1000. But although the resistance changes are indicative of the cooling, quantitative relations could not be deduced because of the very complicated nature of the phenomenon.

It would seem that the double filament lamp would probably show a greater decrease in mean horizontal candle-power due to bending than any other type of lamp made in the United States. The two loops of which the filament is composed are long and slender, and being unsupported are susceptible to centrifugal forces. Moreover, the candle-power in the direction of the tip is very small and consequently the decrease in the effective length of the sides of the loop on rotation is not compensated to any extent by the tip. A lamp having a relatively large tip candle-power would not be expected to show as much decrease in mean horizontal candle-power due to bending as a lamp with a small tip candle-power. But although the double filament lamp seemed to the writers to represent one of the worst cases for high-speed rotation, since the large errors found by Uppenborn were obtained with filaments having a turn in them somewhat similar to the common oval anchored filament, it was thought desirable to make some tests with lamps of this type.

The maximum error which Uppenborn obtained, —9.3 per cent, was found for a 32-cp, 110-volt, 1½ turn oval filament with no anchor. Since the writers do not know of any type of lamp made in the United States corresponding exactly with that described by Uppenborn, they obtained through the courtesy of the Franklin Electric Manufacturing Company two special lamps (Fig. 1, No. 4), which were identical in every respect with the regular 32-cp, 110-volt oval anchored lamp except that the anchor wire was omitted, in order that the filament might be left as unstable as possible. The dimensions of the filament agreed approximately with those given by Uppenborn, the total height of the filament used at the Bureau being about 75 mm instead of 65 mm, and the vertical axis of the oval being 50 mm instead of 40 mm.

These two lamps were studied in the same way as the double-filament lamps described above, except that the readings by the point-to-point method were made every 15 degrees instead of every 10 degrees as in the preceding determinations. Lamp No. 4 was first measured at different speeds up to 600 r. p. m., the greatest change in mean horizontal candle-power, as compared with the value determined by the point-to-point method, being only 1 per cent. In these determinations the filament did not touch the bulb, although it approached close to it. Subsequently the lamp was kept at a speed of 600 r. p. m. for some minutes, and though at first the filament was separate from the bulb it gradually spread and ultimately came into contact with the glass. Just before the filament reached the bulb, the mean horizontal intensity was about 1 or 1.5 per cent low. but after coming into contact, the intensity decreased to a value 3 or 4 per cent lower than that determined by the point-to-point method. The current also underwent a very appreciable change when the filament touched the bulb.

The speed was now increased to 800 r. p. m. at which both loops were in contact with the glass (Fig. 1, No. 4, distorted). The mean horizontal intensity was found to be about 7 per cent low, and the current to have undergone another change in the same direction as before. While rotating at the high speed of 800 r. p. m. a star crack developed and the filament burned out, so that it is possible that a part of the observed 7 per cent change in candle-power may have been due to the constantly deteriorating vacuum.

The other special 110-volt, 32-cp lamp (No. 5) showed approximately the same characteristics as lamp No. 4, except that the filament touched the bulb first in one point and then in a second point, the mean horizontal intensity decreasing to about 97 per cent of its original value as determined by the point-to-point method. The current also showed a marked change due to the cooling of the filament.

In addition to the two special 32-cp, 110-volt lamps, the Franklin Electric Manufacturing Company furnished also two special 32-cp, 220-volt lamps without anchors. The filaments were of the 2½-turn type, such as are usually provided with two anchors. (Fig. 1, No. 6.) Without the anchors the filaments are quite unstable and entirely unsuited for high speed rotation. Consequently they were forced against the bulb at the comparatively low speed of 400 or 500 r. p. m. Before touching the bulb the decrease in candle-power was not more than 1 per cent for either lamp, and, in fact, the error due to the flicker, which is somewhat annoying for this type of lamp at the low speed of 200 r. p. m., was of the same order of magnitude as that due to bending. It is interesting to note in this connection that the same kind of error due to flicker was observed in these experiments as that described in the former paper. Thus while one observer obtained for the flickering light a value higher than that obtained by the point-to-point method, the other observer obtained a value lower than the true value. Moreover, the two observers deviated from the true values in the same way as they did previously in the original investigation. This point will be mentioned again later. It is sufficient to note here that at the higher speeds this error due to flicker disappeared and the different observers obtained approximately the same errors due to bending.

At speeds of 600 to 700 r. p. m., when the filaments were well over against the glass, the decrease in candle-power reached a value as high as 4 per cent for one of the lamps, but whenever the change in candle-power was large there was always a very appreciable change in resistance, indicating that the change in candle-power was due probably to a large extent to a cooling of parts of the filament. In Fig. 1, lamp No. 6, is shown both when new and after having touched the bulb and burned out. At the high speed of 675 r. p. m. one loop was short-circuited by the next and the filament burned out at the point of contact.

From a consideration of all the data given in the preceding paragraphs it is seen that the maximum error observed, due to a bending of the filament, was not in any case greater than 1.5 per cent, provided the filament did not touch the bulb, even though the filament was bent so as almost to touch the bulb. The speed of rotation necessary to force the filament against the bulb was not less than 600 r. p. m. except for the special 32-cp, 220-volt lamps, without anchors, and for these it was from 400 to 450 r. p. m. For most common types of lamps the speed would be much higher than 600 r. p. m., and it is probable that for some types a rupture of the filament would occur before the filament would touch the bulb.

When the filament touches the bulb changes in candle-power of as much as 6 or 7 per cent may take place, but as these large changes are always accompanied by relatively large changes in resistance, it is probable that they are due to a cooling of the filament owing to the contact with the glass.

EFFECT OF BENDING.

As explained in detail in the orginal paper referred to above, the difference between the value of mean horizontal intensity obtained by the point-to-point method and that obtained by the rotating lamp method may be ascribed to two possible causes—the effect of bending of the filament on rotation and the effect of the flicker on the ability of the eye to estimate correctly the true mean values. In the method used at the Bureau in the original investigation these two elements could be separated, but in the method used for the present experiments, as also in the method of Uppenborn, both elements were present and the resultant effect was obtained. Since in the experiments

at the Bureau the flicker, with the types of lamps studied and at the high speeds used, was always practically eliminated, the conclusions in regard to bending at the high speeds, obtained by comparison with the point-to-point values, should be correct. At the lower speeds, judging from results obtained previously, the error would probably be negligible for all types studied except the 32-cp, 220-volt lamps to which attention was called in passing.

Uppenborn recognizes the two effects of bending and flicker and attempts to study them separately, but the methods which he used will not yield correct quantitative results, and in the case of the effect of flicker will fail to show, even in a qualitative way, the most important element.

Thus in studying the change in mean horizontal intensity of different types of filaments at different speeds, use is made of the observation that, corresponding to a decrease in mean horizontal intensity on rotation, the end-on candle-power, or intensity in the direction of the tip of the lamp, is increased. Although this is true in a general way there is no definite constant relation between the changes in mean horizontal and end-on candle-power. This can be seen readily by considering a simple hypothetical case.

If we suppose a single straight filament mounted vertically the mean horizontal intensity would be the intensity normal to the filament in any azimuth, being the same in all azimuths. The end-on candle-power would be zero. Now if on rotation the filament was bent slightly the change in mean horizontal intensity would be quite small, whereas the percentage increase in end-on candle-power would be infinite. Even if we compared the actual change in candles the end-on change would be very much larger than the change in mean horizontal intensity. If now the filament initially had been inclined slightly so that the initial end-on candle-power was different from zero, then for a definite decrease in mean horizontal candle-power on rotation the percentage increase in the end-on candle-power would be a finite quantity. It is, therefore, evident that at least theoretically the percentage change in end-on candle-power is no indication of the percentage decrease in mean horizontal intensity.

In order to show what differences could exist in practice, the double filament lamp No. 2 was measured for end-on candle-power at rest and when rotating at 350 r. p. m. Whereas at this speed the mean horizontal intensity showed a decrease of 0.6 per cent, the end-on candle-power showed an increase of 17.5 per cent. The actual change in mean horizontal candle-power was from 16.0 to 15.9, and the change in end-on candle-power from 7.7 to 9.05. On the other hand, a lamp of the "downward light" type showed no appreciable change in end-on candle-power at a speed of 425 r. p. m., although it was found in the previous investigation that for this type of filament the effect of rotation was to increase the mean horizontal intensity by about the same percentage amount as the observed decrease for lamps of the double filament type.

It is evident, therefore, that the percentage change in end-on candle-power cannot be taken as a criterion for determining the effect of rotation on the mean horizontal intensity.

EFFECT OF FLICKER.

One effect of a fluctuating illumination producing the sensation of flicker is a diminished sensibility in making a photometric setting. This is the element which Uppenborn investigated. There is another and more important element, however, which he failed to observe. Not only is the sensibility decreased, but the mean reading may itself be in error by several per cent. As shown in the previous paper on this subject some observers ascribe too high a candle-power value to a flickering light, others too low a value, and sometimes every individual setting of one observer may be entirely without the range of the individual settings of another observer. A large number of readings will reduce the probable error due merely to lack of sensibility, but will not correct for the erroneous judgment of the point of balance of a flickering light.

For many of the common types of lamps in use in the United States the error due to flicker at a speed of 300 or 400 r. p. m. is probably not very great with most experienced observers; and since the error due to bending is quite small at these speeds the rotating lamp method is convenient and reliable in commercial testing. For the photometry of lamps having an annoying flicker, or for the more accurate measurement of lamps with a moderate flicker, the simple expedient of employing an auxiliary mirror as described in detail in the former paper referred to above will be found very satisfactory.

An Analysis of the Distribution Losses in a Large Central Station System.

At a regular meeting of the Boston Branch of the American Institute of Electrical Engineers held on May 15, Mr. L. L. Elden, electrical engineer of the Edison Electric Illuminating Company, of Boston, presented an exhaustive paper on the "Distribution Losses in a Large Central Station System." The meeting was largely attended and the paper received an enthusiastic welcome from the audience.

Mr. Elden pointed out that the particular system under consideration consists of two main generating stations, one generating three-phase, 60-cycle alternating-current exclusively, and the other low-tension direct current. In addition, there are 18 sub-stations located at distributing centers for the purpose of supplying either direct or alternating current for commercial uses from the high pressure service derived from the main generating station. There are also two small generating plants located at remote parts of the company's territory which are still in service independent of the main system. These generating plants will be discontinued as soon as is convenient, and be converted into sub-stations supplied with current from the main system. Table I shows the main station statistics of the system.

TABLE I.

Cities and towns served	30
Area of territory, sq. miles	450
Population served	1,000,000
Miles of streets in territory	1,800
Miles of streets covered by company	750
Maximum distance reached from main generating station, miles	45
16-cp lamp equivalents connected	1,600,000
Transmission voltages	2,300 4,600 6,600 volts, three-phase
Types of distributing circuits	2,300-volt, single-phase 2,300-volt, three-wire, three-phase 2,300/4,000

It was found convenient and economical to maintain the 2300-volt and 4600-volt service which was in use in certain locations, rather than to abandon the relatively large equipments represented by the exisiting installations. These lines are used for comparatively short distances, and no further extensions of them will be made, all new transmission lines being constructed and used for the 6600-volt service.

The 2300-volt, single-phase circuits are used in residential districts where no motor service is required, the 2300-volt, three-wire, three-phase circuits being used in the smaller districts where limited areas are to be served for residential lamp and motor service. The 2300 to 4000-volt, four-wire, three-phase circuits are used in the districts covering large areas to be supplied with residential lamp and motor service.

The territory supplied is divided into two distinct districts, in one of which only 115-230-volt, three-wire direct-current service is supplied, and in the other only 115-230-volt, single-phase, and 230 and 550-volt, three-phase service is furnished for commercial purposes. In addition there is also the street lamp service of 6.6 amperes, either direct or alternating current according to the location. In the growth of its business during the past 25 years the company has absorbed the business of other companies as well as having enjoyed the natural growth of its own lines. A few years ago it was found that some 20 different forms of service were being supplied, with the attendant complications in operating the system. It was apparent from a comparison of the energy sold with the energy generated that the difference was too great, and to ascertain the reason a complete survey of the whole system was undertaken

with a view of eliminating the uneconomical features. This investigation involved an examination of each customer's connected load and demand, the capacity of and demand on each transformer in the alternating-current district and the losses in transmission lines, feeders and mains, the operation of all station apparatus, the accuracy of all watt-hour meters, and in general all the details of the service. As a result of this inquiry it was found advisable to proceed with the changes necessary to remove the objectionable and uneconomical features. These changes, which were commenced in 1903, affected the following parts of the system:

First, a certain district was specified in which no form of service other than three-wire, 115-230-volt direct-current would be supplied. This made it necessary to transfer all the alternating-current customers affected to the direct-current system, remove all transformers in the district and reconnect the alternating-current mains as a part of the direct-current system. The 500-volt service was abandoned, and all motors located in the direct-current district were adapted for 230-volt direct-current service, while such as were outside the direct-current district were replaced by alternating-current motors. A number of new sub-stations were installed in the direct-current districts to serve the rapidly increasing business, and at the same time to reduce the excessive losses in feeders and mains, by shortening and rearranging the distributing points of existing feeders, as well as of the new ones.

In the alternating-current district, secondary networks were installed and the number and capacity of transformers reduced, the total reduction in this case being 30 per cent of the installed capacity. Changes in the sub-station apparatus were effected by the introduction of new apparatus, all adapted to supply the standard forms of service.

The results of these changes are shown in Table II.

TABLE II.

	Kw-hours Generated.	Kw-hours Sold.	Per cent of Generated.
Year ending June 30, 1903....	49,122,344	31,569,741	64.26
" " " 1904....	57,531,315	37,220,199	64.67
" " " 1905....	64,161,987	41,910,281	65.31
" " " 1906....	74,582,311	52,003,000	69.82

In four years there has been an increase of 5.56 per cent in the percentage of sales as compared with the manufactured energy. This result is an average for the whole year 1906, but in the last six months the percentage has risen to 73.65, which indicates the possible future results.

As it is the practice of this company to use motor-generators in preference to rotaries to transform the three-phase alternating current into 115-230-volt direct current, it may be suggested that a further economy could have been effected by the use of rotaries. The motor generator equipment of the company comprises 36 units having a total capacity of 10,210 kilowatts, and varying in size from the 1000-kw direct connected sets to the 60-kw Edison bi-polar belted units which have been retained in service in some of the smaller stations. In Table III are shown the actual results of the operation of this apparatus for the year 1906, and also the estimated results of the use of rotaries of the same size, operated in the same manner as the motor generators were, and at an efficiency assumed from the manufacturers' data on such sizes of apparatus.

TABLE III.

	Kw-hours Received.	Kw-hours Delivered.	Per cent Efficiency.
230-volt motor generator....	31,331,406	25,803,990	82.4 actual
230-volt rotaries	30,004,639	25,803,990	86. assumed
Energy saved by rotaries....	1,326,767		

The operating efficiency of the rotaries as used is estimated at 87 per cent, less 1 per cent for the power used by the cooling apparatus, while the motor-generator efficiency used was 82.4 per cent. The saving by the use of rotaries represents the premium paid for the use of the more reliable apparatus, in addition to which there is to be added the slightly larger investment necessary in the purchase of motor-generators. Owing to the well-known difficulties incident to the operation of 60-cycle rotaries in a large system where continuity of service is placed above all other considerations, it is a question of individual opinion as to which type of apparatus a company should adopt.

Table IV illustrates the comparative losses in the alternating-current and direct-current systems, omitting the street lamp service:

TABLE IV.

	Per Cent. A. C.	Per Cent. D. C.
Total losses from generating station to customers' meters.	41.1	20
Efficiency of system.....	58.9	80
Total losses from sub-station to customers' meters.....	24.2	7.54
Efficiency of distributing system.....	75.8	92.46
Area of system per cent of total.....	99.1	0.9
Connected load per cent of total.....	21.6	78.4
Connected load in kw.....	17,300	62,700
Transformer capacity installed, kw.....	10,388	....
Transformer capacity in per cent of connected load.....	60	....
Energy delivered in per cent of total generated, approx...	30	70
STREET LIGHTING SYSTEM.		
Total losses from generating station to street lamps.....	15.2	31.9
Efficiency of system.....	31.9	68.1

In the alternating-current system the total losses including those in the transmission circuits, step-down transformers and distributing circuit losses, also meter losses, aggregate 41.1 per cent; thus the system efficiency is 58.9 per cent. Eliminating the losses in the transmission lines, step-down transformers, regulators, boosters, etc., the total losses in the distributing circuits, meters, etc., aggregate 24.2 per cent, with a resulting efficiency of 75.8 per cent from the sub-station to the customers' meters.

In the direct-current system the total losses including those in transmission lines, motor-generators, tie lines, feeders, mains, meters, etc., aggregate 20 per cent. Eliminating all losses in the direct-current system except those which occur between the direct-current bus-bars in the sub-station and the customers' meters, the total loss is 7.54 per cent in terms of the power delivered at the sub-station direct-current bus-bars.

Two forms of street lighting service are in use, each involving the use of a different type of apparatus. In one case, motor generators are used to convert alternating current into 6.6.-ampere series direct-current, and in the other case, constant-current transformers are used to obtain the 6.6 ampere series alternating current for similar service.

Tables V to IX inclusive present a summary of the year's operation, but in actual service these tables are made up each month. In these tables, with the exception of such items as are preceded by an asterisk, all the data shown are the results of watt-hour meter readings. In the case of the excepted items, computations were made from reliable data furnished by the manufacturers, supplemented in many cases by company tests.

The losses in the individual commercial distributing circuits were determined by the drop of potential method, a constant being obtained for each circuit by taking a large number of pressure tests under all conditions of load. The losses in the direct-current mains were estimated in the same manner. The losses in the street lighting circuits were calculated from the known length of the circuits and these results further checked by voltage readings at the station, while the circuits were in operation with a known number of lamps burning. Each year the company makes thousands of tests of consumers' meters, and in 1906 the average results of all such tests showed that the average meter error was 2.6 per cent slow. This factor has been used to account in part for some of the unknown losses, the total thus accounted for being about 1.5 per cent of the total generated.

TABLE V.

DISTRIBUTION OF ENERGY FOR YEAR ENDING JUNE 30, 1906.

	Kw-Hours.	Per Cent of Total Generated.	Per Cent of Energy Transmitted
Commercial sales	52,003,000	69.82	
Company use	2,774,383	3.72	
Total losses	19,270,616	25.87	
Unaccounted-for energy	441,437	.59	
Total generated.....	74,489,436	100.	
SUB-DIVISION OF TOTAL LOSSES.			
Losses in station apparatus.....	10,536,117	14.21	16.6
Losses in inter-station lines....	2,920,653	3.92	5.92
Losses in feeders and mains....	5,763,846	7.74	10.50
Total losses.....	19,270,616	25.87	

Table V shows in the first part a summary of the principal

items without sub-division. The latter part of the table divides the losses into sub-heads which are repeated individually in the later tables.

In Table VI the losses in station apparatus are sub-divided and distributed among the various pieces of apparatus used in station operation.

TABLE VI.

	Kw-Hours.	Per Cent of Total Generated.	Per Cent of Input.
230-volt motor generator	5,527,416	7.42	17.6
500-volt motor generator	373,059	0.50	33.6
Series-arc motor generator	2,403,471	3.22	25.5
Step-down transformers	1,010,848	1.36	3.23
Constant current transformers	118,548	0.16	5.40
Potential regulators	65,353	0.09	5.53
Batteries	807,067	1.09	43.2
Boosters	211,264	0.28	63.0
Balancers	67,725	0.09	....
Water rheostats for testing	1,366	....	....
Total	10,586,117	14.21	

Table VII indicates the losses in the inter-station transmission lines:

TABLE VII.

	Kw-Hours Lost.	Per Cent of Total Generated.	Per Cent of Input.
Three-phase, 2300-volt lines	1,556,981	2.09	8.41
Three-phase, 4600-volt lines	98,813	0.132	1.52
Three-phase, 6600-volt lines	770,577	1.04	3.55
230-volt direct current tie lines	494,282	0.66	18.30

Table VIII shows similar data from feeders and mains:

TABLE VIII.

	Kw-Hours Lost.	Per Cent of Total Generated.	Per Cent of Input.
*2300-volt commercial lines	1,854,854	2.5	25.1
*230-volt D. C. feeders	1,901,948	2.55	4.93
*230-volt D. C. mains	641,343	0.86	2.00
*500-volt D. C. feeders	74,466	0.10	9.15
*Street lamp circuits	809,103	1.08	9.53
*Meter potential losses	482,132	0.65	....
Total	5,763,846	7.74	10.5

Table IX shows the percentage of sales in each sub-station district, as compared with the energy delivered to that district for distribution. Stations 1 to 13 include the direct-current district and a portion of the alternating-current district. Nos. 14, 15, 17 represent stations to which energy is sold wholesale to be redistributed by the local companies controlling these districts. Stations 16, 19, 20, 23 represent sub-stations, each of which supplies energy to one or more cities or towns in the suburban districts. Stations 18, 25 represent small generating plants which are still in service in two of the recently acquired suburban districts. Station 16 supplies a district where many motors are used, also a large number of street lamps. Station 18 does the same kind of business, but on a smaller scale. Stations 19, 20, 23, 25 supply energy to districts covering large areas where residential lamps and a moderate amount of streets lamps are the only consuming devices.

TABLE IX.

Station.	Sales in Per Cent of Energy Received.
1—13	68.9
14	100.
15	100.
16	75.
17	98.3
18	63.5
19	55.4
20	52.4
23	55.9
25	72.8
Average	69.8

The preparation of this data involves the labor of one man for about one week each month. It is his duty to watch the operation of the system through the statistics furnished to him by the operating and sales departments, comparing them with data which have been prepared representing the possible maximum conditions of efficiency of operation of every piece of apparatus on the system, and reporting for investigation any divergence from the estimated average operating losses. The curves which are prepared monthly show the percentage of losses in the energy handled by each motor-generator, storage battery, balancer, booster, exciter, step-down transformer, constant-current transformer, or any other station apparatus, thereby providing means for detecting at once any unusual results; thus furnishing a check on the operation of the system. In addition to the value of this information from an operating point of view, is is very desirable in indicating the worth of each district as a revenue producer, thus making it possible to judge accurately of the advisability of making extensions for the different classes of service.

In the discussion which followed the paper, Mr. Elden stated that the power factor on his system as a whole often runs as low as 75 per cent during the hours of light load, but at night it is brought close to 100 per cent by the use of synchronous apparatus. One-third of the motor-generators are of the synchronous type. Some induction apparatus is used to prevent surging. About 4 per cent of the company's output is used by the company itself, including the power for station auxiliaries. On the whole, the system meter potential losses aggregate 110 kilowatts. The load factor of the whole system for the year is about 40 per cent; that of the main alternating-current station, which does the bulk of the work, is about 55 per cent. The meters in the stations, which are the most important, are checked monthly, and any error is eliminated before it assumes a large value.

Gyroscopic Mono-Rail Traction System.

At a recent meeting of the British Royal Society Mr. Louis Brennan, inventor of the Brennan torpedo, gave an experimental demonstration of the practicability of a mono-rail traction system in which the cars are arranged with their center of gravity several feet above the points of support. The predominating feature of this system resides in the use of the gyroscope for maintaining the stability of the cars upon the rail. The mechanism exhibited consists essentially of two flywheels rotated directly by electric motors in opposite directions at very high speed, the flywheels being so mounted that their gyroscopic action and stored up energy can be utilized. In order to overcome the inherent side thrust of a gyroscope when an attempt is made to change its plane of rotation, the inventor

FIG. 1.—MODEL GYROSCOPIC CAR.

causes the two gyroscopes to rotate in opposite directions. The plane of the wheel is vertical and normally its axis is at right angles to the length of the car; that is, to the track.

The well known property of the gyroscope is its tendency to maintain its plane of rotation. If either gyroscope is turned about the vertical axis it will exert a resisting force about a horizontal axis. When the car tends to roll over the frame carrying the whole gyroscope mechanism tends to remain horizontal, but in doing so it alters its position with respect to the car body. The mechanism is so arranged that the frame opens a valve or closes a circuit, and mechanical devices are brought into play to tend to bring the car to its normal upright position. Thus if a heavy load is placed on one side of the car the gyroscope mechanism causes the loaded side of the car to rise until the center of gravity of the whole car unit with load is directly above the supporting rail, as indi-

cated in Fig. 2. The stability mechanism occupies very little space, and is conveniently placed in the cab at one end of the vehicle. Its weight is also small, about 5 per cent of the total load being considered an ample allowance for the first vehicle.

The experimental car is about 6 ft. long and each pair of wheels is driven through gearing from electric motors car-

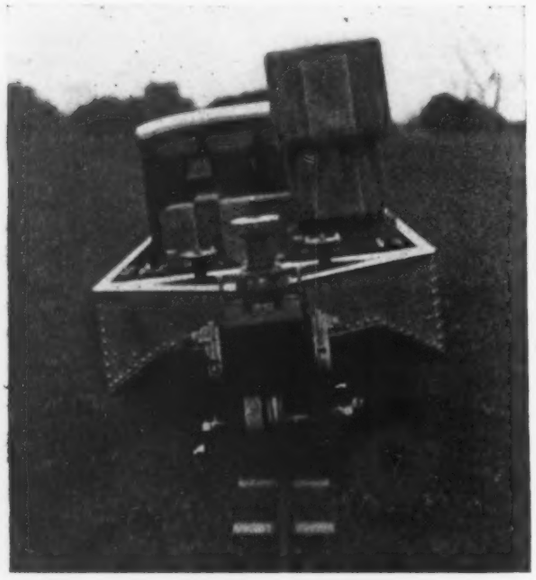


FIG. 2.—EFFECT OF UNEQUAL LOADING OF MODEL.

ried on boggies. The power for propulsion is derived from a number of small storage cells placed inside the car. It is stated that the rail, which is of ordinary section, need be of no greater weight than one of the rails on an ordinary line in order to carry the same load on the same number of wheels in each case. The ties also need be only one-half the length used at the present time in order to give the same area of support to the vehicle.

It is anticipated that the speed with which a single rail may be laid over uneven ground with slight expenditure of labor will allow the mono-rail system to keep up with an army on the march and supply them with all their requirements. It is stated that the Indian Government has voted $25,000 for the construction of a full-sized vehicle and the British War Department will construct the necessary rail upon government land at Chatham, near the inventor's home.

Report of the N. E. L. A. Public Policy Committee.

The National Electric Light Association at its Washington Convention, June 4 to 7, devoted one evening to the discussion of the report of its Public Policy Committee and of various sub-committees. This Public Policy Committee consisted of Everett W. Burdett, counsel for the Boston Edison Company; Henry L. Doherty, Alex. Dow, manager of the Detroit Edison Company; Charles L. Edgar, president of the Boston Edison Company; Samuel Insull, president of the Chicago Edison Company; J. W. Lieb, Jr., general manager of the New York Edison Company; Joseph B. McCall, president of the Philadelphia Electric Company, and Samuel Scovil, vice-president of the Cleveland Electric Illuminating Company. The secretary of the committee was W. H. Gardiner, of Henry L. Doherty & Company. A portion of the main report expressing the adopted sentiment of the convention as to relations with the public, franchise terms and government regulation and supervision is as follows:

The committee calls special attention to the report of the sub-committee on the London Sliding Scale as Applied to Electricity, and to the great practical importance of the subject. The committee joins in urging "the very serious consideration of the application of this attractive theory to the business of the various companies interested as soon as a safe and satisfactory working basis for it can be established." If the practical details in its application to electricity can be successfully worked out, there is little reason to doubt that the relation of the companies to their cusomers and the public will be very much improved, with distinct advantages to both.

It has recently been well said: "The American public is in the long run fair. It errs oftener from ignorance than from malice. It is sentimental in the highest degree, and can be led by prejudice or emotion to extremes. If it has put before it clearly all the facts, its sound common sense will come to the rescue, and sentimental reformers and schemers with axes to grind will go out of business; but until corporations present their side of the case aggressively and with absolute honesty the public will follow the lead of those who make a living by attacks upon all corporations indiscriminately."

Questions of Taxation and Franchises, which have occupied the attention of one of the sub-committees, are of great importance. We think there should be an agreement among the parties in interest upon some of the fundamental propositions which underlie these questions, particularly with respect to the subject of taxation. It should never be lost sight of that every form of taxation of public-service corporations is a tax upon the consumer. While these companies should, of course, pay

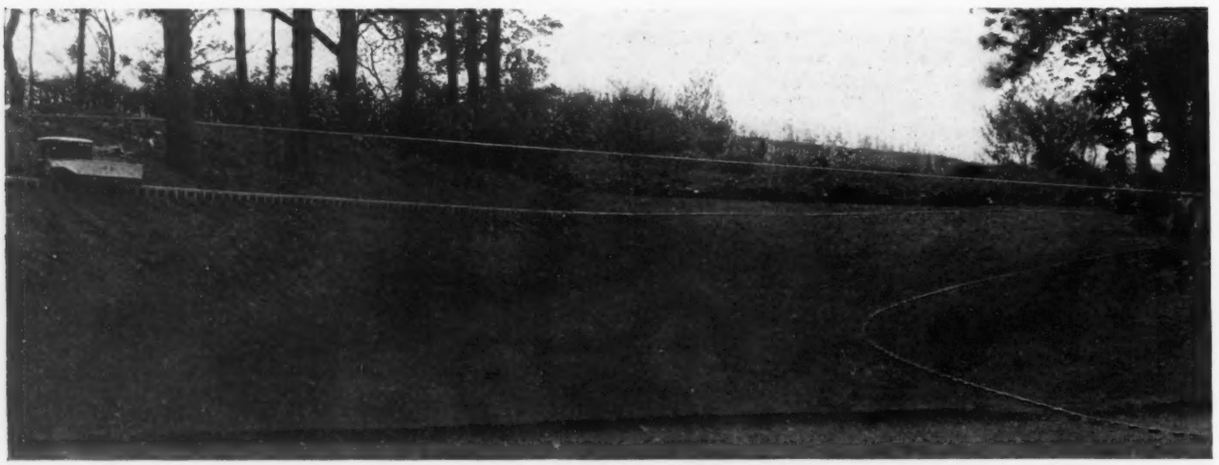


FIG. 3.—VIEW OF MODEL TRACK.

into the public treasuries their full share in discharge of the general public burdens, whatever is exacted from them in the form of excises or taxes in excess of what others similarly situated are required to pay distinctly operates against reductions in charges for the service rendered or a limitation of the facilities furnished. In other words, if these public utilities must make special contributions to the public funds, it must necessarily be at the expense, in one form or another, of the particular members of the community who use their service. Inasmuch as this service is theoretically universal, in the sense of being available to all citizens desirous of using it, it should be furnished at the lowest figure practicable. The effort of every public-service corporation ought to be to increase its facilities and reduce its charges as rapidly as possible, and it should not be handicapped in doing so by exactions on the part of the public at large, which reduce the ability of the companies to do so by the amounts exacted. In other words, whatever contributions public-service corporations make to the public, aside from their proportion of general taxes, should be made to those who use their service. If this simple but fundamental proposition were universally recognized, there would be an end of legislation to impose special taxes and excises upon public service corporations, whose use of the public streets is, after all, required by the public for its own convenience. If, however, it shall be necessary in particular instances to acquiesce in a popular demand for special payment for the use of public streets, the public should be educated to the knowledge of the effect upon rates and facilities which the application of such a theory involves.

Another proposition which is fundamentally important, both to the companies and to the public, is that the franchises of the companies should be for such terms and upon such conditions as will best subserve the interests of both. As in the case of taxation, the interests of both are really the same. The undue restriction of franchises is analogous in its results to the imposition of unwarantable taxes. Both operate to deprive the company of the incentive and the ability to give the public the best service at the lowest rates. A short-term franchise involves the necessity of the creation of a sinking fund, at the expense of the consumer, to protect the stockholder against loss of his investment before the end of the period of natural use. It also removes all incentive for the company to make permanent improvements, particularly in the latter part of the term of its franchise. A short-term franchise operates to induce the company to adjust its charges in view of the limited time in which it is permitted to recoup its investment and make its profits. The natural results are higher prices, larger reserve funds, poorer equipment, less efficiency of service, than would be the case if the tenure of the company were more extended. A long-time limited franchise is subject to the same objections, except that the inevitable day of inadequate equipment and poor service is longer postponed, and the accumulation of necessary reserves involves a smaller tax on the consumer because extended over a longer period.

It follows, therefore, that unlimited franchises, reasonably restricted in their terms and conditions and properly guarded against abuses, will produce the best results for the public, because they will enable the corporations to prosecute their business on a permanent instead of a temporary basis. There is no magic in this result. It is exactly the same as can be predicated of any private business. If one's opportunity to make money is brief, he will make money as fast as he can, without much reference to the future. If, on the other hand, he is in business to stay, and has regard to his future as well as his present financial condition, he builds for the future as well as for the present, and will not be tempted by the prospect of immediate profits to sacrifice either his future financial ability or reputation.

The subjects of Municipal Ownership and of Public Regulation and Control of public utilities are intimately connected with each other. Neither can be adequately discussed without reference to the other. Indeed, one is the alternative of the other. Municipal ownership is demanded largely because of the absence of proper public regulation and control. Public regulation and control, if efficient, removes the necessity or excuse for municipal ownership by securing fair treatment for the public.

If, therefore, a system of public regulation and control, which is at once fair to the corporate interests involved and efficient in securing the results to which the public is equitably entitled, can be evolved and put into operation, municipal ownership can no longer be alleged to be essential to the public interest. What the public wants is efficient and adequate service at fair prices. This is all that could be hoped for from municipal ownership, which, if successful in those particulars, would involve financial risks and political consequences which it is of the highest importance to avoid. Leaving out of consideration those political theorists who adhere to the doctrine that the government should govern as much instead of as little as possible, and that a public official should be substituted for a private citizen whenever and wherever possible, the great body of our people prefer the original American idea, that the functions of government should whenever practicable be restricted rather than enlarged, and that undertakings of an essentially business character are best entrusted to private enterprise rather than to political manipulation. The public funds should be employed solely for public purposes and the tax levy should not be subjected to the perils of commercial enterprises.

But, adhering to these sound tenets, a large body of the public feels itself driven to the more or less favorable consideration of municipal ownership, by the belief that in no other way less objectionable on general principles can those results to which the public is entitled be obtained. Where private enterprise results only in private gain and not at all or only insufficiently to public advantage, the demand for municipal ownership is natural and inevitable. This fact alone suggests the antidote. If private enterprise results to the public advantage as well as in private gain, the basis for the demand for public ownership is gone.

Assuming, however, as a knowledge of human nature compels us to assume, that a recognition of these fundamental principles cannot be expected on the part of all owners of private industries, we are forced to the consideration of measures to compensate for that fact. That which is now uppermost in the public mind is public supervision and control. In the judgment of your committee some form of such supervision and control is inevitable in many if not all of the important states of the Union, and we believe that it should be welcomed by the parties in interest, provided it is put, as we believe it can be, in such form as to preserve the rights and properties of the companies as well as to promote the interests of the public. The practical question is not so much whether there is to be such regulation and control as it is what the nature and form of them are to be. The public demand for it is shown, not only in the pronounced attitude of the President of the United States with respect to inter-state railroads, but by the extreme activity of many important state legislatures that are now sitting or have just adjourned. Bills proposing public regulation and control of public-service corporations have this year been introduced into the legislatures of at least fourteen states. They deal with the subject in a variety of ways. The diversity of their provisions indicates at once the wide-spread interest in the subject and the merely tentative hold which as yet those dealing with it often have upon the true principles that underlie it.

While an agreement may be reached upon the general principle that public regulation and control of public-service corporations is desirable in the public interest, and is not necessarily inimical to the safety and value of corporate investments, it is another and much more difficult matter to agree upon the nature and scope of it. Three systems may be suggested: First, one like the Massachusetts and New York systems, under which everything is practically left to the judicial or quasi-judicial discretion of state officials, clothed with amplest power. Second, a system that, so far as possible, will be automatic or semi-automatic in its operation, through the applica-

tion of statutory requirements to existing conditions by administrative officials. Third, a system that will be a compromise between, or involve an application in part of the features of, both of the foregoing.

In our discussion of this matter we assume the soundness of the economic proposition that the lighting business is essentially non-competitive in its nature; that competition not only involves the duplication of investments and of obstructions in the public ways, but must result in present waste and ultimate additional burden on the public to compensate therefor. Competitive public utilities of the same nature inevitably result in burdening the service and its customers with duplicate plants, the fixed charges of which more than offset such reductions in rates as may result from competition. Our discussion of the subject now in hand has therefore no application to localities where the soundness of the doctrine which we have stated is not recognized.

Whatever claims of superior efficiency may be advanced in favor of a system of supervision and control of the type that was proposed for New York are offset by the objection of placing the vast interests of stockholders in the keeping, and, as history shows, frequently at the mercy, of public functionaries, who sometimes are but more frequently are not fitted by education or experience for the discharge of the delicate duties of their positions. Nothing stands between the companies and the exercise of the unrestrained action of such officials but the guaranties of the Federal Constitution. But such guaranties only protect against absolute spoliation, and furnish no redress for lesser, but almost equally serious injuries, which may be inflicted through official action.

One great difficulty under systems of undefined public control is the inability or unwillingness of officials to distinguish between the regulation and the operation of corporations. Regulation should stop where operation begins. Matters of business discretion should be left to the decision of those who are responsible for business results. The directors of the affairs of a corporation undoubtedly, in most instances, are better judges of questions of business expediency than outside officials, however enlightened.

But it is always the tendency of public bodies clothed with judicial powers or official discretion to enlarge their own jurisdiction, and it is not therefore to be expected that they will set proper limits to their authority.

The remedy for this difficulty is to have the obligations of the corporations and the authority of the officials so defined by statute as to make the operation of the provisions of the law upon the state of facts in hand as nearly as possible automatic, calling for the interference of public officials only to the extent of applying the law to the facts as found. The ascertaining of the facts need not, and usually would not, involve to any considerable extent the exercise of discretionary or judicial functions. In short, under such a system the supervisory officials are in the position of a jury, accepting the law directly from the legislature and merely applying it to the facts as found by them.

If the objection is made that such a suggestion needs demonstration of its practicability before it is accepted, the answer is that if the theory is sound it can undoubtedly be worked out in practice, though many details may have to be developed and perfected through experience. But that such a system is practically as well as theoretically sound, is demonstrable through the application of the so-called "Sliding Scale." This, when once adjusted to the case in hand, will automatically settle the great questions of Rates and Dividends, to the satisfaction of both the private and public interests involved. The settlement of these two important items—one the most foremost from the public's point of view, and the other the most important from the corporate point of view—will go far toward removing other difficulties.

The question of original capitalization or increase of capital becomes simplified by the adoption of the sliding scale, because any tendency to overcapitalization will be restrained by the fact that the securities of the company can be made valuable only as and to the extent that rates are reduced. So far as this consideration does not operate to keep the capitalization within proper limits, it is a comparatively simple matter for public officials to decide how much capital is required for a given purpose, and to limit the amount accordingly. They should have nothing to say about the reasonableness of the purpose for which it is wanted, or as to the wisdom of the investment; those are business questions, the decision of which should lie exclusively within the province of those responsible for the business results of the enterprise. The business necessity for capital having been thus determined, the function and authority of public officials should be limited to seeing that the purpose of the issue is a lawful purpose, and that a sinister design to secure an undue inflation of capital is not hidden behind an apparently legitimate purpose on the part of the corporation.

The matter of compulsory supply and of quality of service, although necessarily involving the exercise of more or less discretion, may nevertheless be so carefully provided for by statute as to render the application of the statutory requirements to the facts presented in any given case comparatively simple and easy. Indeed, the questions involved in proceedings for compulsory service are judicial questions, for which the principles of the common law furnish satisfactory solutions. Those principles, supplemented by whatever statutory additions or changes local conditions may seem to require, will be found to furnish an adequate and complete remedy to any one entitled to a remedy. If it is objected that it would involve an undue burden on the private consumer to compel him to seek a private remedy for an evil which the public should deal with, the objection is met by the suggestion that the public official or board charged with the duty of public regulation and control could be required, upon the complaint or application of private consumers, to institute and prosecute the necessary proceedings to secure judicial action.

Even the extension of the territory served by a company and the increase of the availability and adequacy of its service, can be made the subjects of the automatic operation of the theory of the sliding scale. If the company's right to increase of dividends is made to depend not only on reductions in price, but also upon increase of output—that is, extension of service—it will in its own interests, but with corresponding advantage to the public, seek new customers and encourage more use of its service by present customers. This is entirely possible as a result of a nice application of the theory of the sliding scale, thus removing by one more step the necessity for discretionary regulation and control.

So that, all things considered, it is not necessary to admit that an automatic or semi-automatic system of public regulation and control is impracticable. Its advantages, particularly in delivering vested interests from the perils inseparable from the exercise of more or less arbitrary discretionary powers, are so great that every effort should be made to secure its adoption in practice.

While the foregoing statement embodies the conclusions to which the studies and consideration of your committee have brought it in dealing with this great question of public supervision and control of public-service corporations, it nevertheless recognizes the fact that not much has heretofore been said along the lines followed in this report, and that public sentiment may not as yet be ripe for the adoption of a system of the character of that advocated herein.

While further discussion and experience may be necessary for the education of public sentiment along these lines, it is nevertheless desirable that that plan which will ultimately accomplish the best results should be exploited. If in the meantime legislation is to take the form of regulation and control substantially like that embodied in the New York and Massachusetts laws, we desire to go on record as insisting that the administration of such a system or systems shall be entrusted to men of the highest ability and irreproachable character. So much depends—indeed, everything depends—upon the honesty and wisdom of the men clothed with such powers—capable of accomplishing so much good and of doing so much damage to public as well as to private interests—that every effort should

be made to obtain them. To that end we would advocate long terms and secure tenure of office, with adequate salaries, sufficient, as far as possible, to remove the element of self-sacrifice in the acceptance and incumbency of the offices.

Inasmuch as in Massachusetts—and perhaps elsewhere—these salaries are assessed upon the corporations, our suggestion of ample compensation for such officials indicates our willingness that, if necessary to obtain the best service, the burden of the adoption of this suggestion shall ultimately be put, in whole or in part, upon the companies in interest.

An important detail in our opinion is that embodied in the New York law—that the term of only one commissioner shall expire at the same time—thus insuring, except for deaths, resignations or removals, a continuous body of experienced men.

We may add that we indulge the hope that, even if the first legislation upon this subject is destined to take the form of non-automatic or discretionary regulation and control, the results of its workings in practice may be the evolution of a highly developed and practicable system of automatic or semi-automatic regulation. We entertain this hope because of our belief in the economic superiority of the one system over the other, and therefore feel justified in believing that ultimately the best will be adopted, even if it is worked out through experience under a less desirable one.

The studies, rulings and declarations of principles by competent commissions should ultimately develop such methods of adjustment of the parallel interests of consumers and corporations as may then be embodied in legislation, operating directly upon the subjects of it, without the necessity of the intervention of officials clothed with a large discretion in its application.

In concluding their report your committee desire to acknowledge their own appreciation of the inadequacy of their work as compared to the possibilities which existing conditions suggest. They have not, however, felt that it was desirable to attempt more than to do as much pioneer work as possible for their successors, by indicating the general principles in accordance with which this work can be best continued.

We believe that the work of the committee is a great work, and should be continued from year to year with all the zeal and wisdom which can be brought to bear upon it. Entertaining as they do the thorough conviction that the interests of the public-service corporations of the country and of the communities which they serve are in truth and in fact identical, they believe these interests will ultimately be shown and acknowledged to be identical. The energies of this committee and of this association should be bent toward bringing about such relations between the public and private interests involved as will demonstrate the soundness of the conclusion above stated.

New Telephone Patents.

TELEPHONE APPARATUS.

Most hook switches are either built once for all in adjustment or else must be adjusted by bending of the parts. To provide a better adjustment, A. Larsson, of Buffalo, has assembled his springs as a unit upon a rocker frame. This frame is secured to the hook mounting so that the springs and hook may have their relative positions changed.

Transmitters usually have a flare mouthpiece, but S. C. Houghton, of Rome, N. Y., has brought out a transmitter without this attachment. There is an annular groove in the transmitter front, and numerous small holes lead from this groove into the diaphragm. This patent is assigned to the Wire & Cable Company of America.

A self-releasing intercommunicating switch forms the subject of a patent granted to F. Walloch, of Berlin, Germany. The set to be used is the hand microphone type and the support stand, sinking under the weight of the set, releases the switch arm.

Service meters for registering the amount of service, or in other words, the number of messages from any station, have assumed many different forms. These have embraced meters to be located at the subscribers' premises and at the exchange and for both automatic and manual operation. One of the defects of the automatic meters has been the registering of lost calls. To obviate this, N. M. Holland, of Brookline, Mass., has arranged a meter so that while a call is counted upon each completed connection upon which a called station answers, this count is subtracted if the operator's plug be withdrawn before both parties hang up their receivers.

PARTY LINE SYSTEMS.

T. S. Mount, of Rhome, Tex., has patented a switch for use with a party line. The switch may at will cut the line at its own station, connect its station to either section and short-circuit the non-used section. A step-by-step system has been invented by F. Vollmer, Winsted, Minn., which embraces a peculiar feature of time limit. As soon as the line has been in use continuously for the predetermined period, the connection is automatically severed and all stations return to normal. This also provides for cases where users forget to restore the line after use.

A combined grounded and metallic party line composed of three wires is suggested by C. A. Wardner, of Brushton, N. Y. Each station has a switch such that it may switch from metallic on two wires to be grounded on one. If the metallic line is busy the grounded alternative is available. Bells may be permanently connected either way and, of course, signalling must be done over the proper circuit. This may involve ringing on a busy circuit, but the inventor suggests that this may some way be made inaudible to those using the circuit.

LETTERS TO THE EDITORS.

Simplified Spelling.

To the Editors of Electrical World:

SIRS—The position of your journal, in regard to simplified spelling, as set forth in the closing paragraph of your editorial on that subject, in the issue of May 25, should undoubtedly meet with the approval of your readers; that is, if interpreted in the liberal and reasonable way indicated by Prof. Brander Matthews in his letter to you published in the issue of June 8.

It is hardly to be expected, when important interests are involved that we should take any very aggressive action in matters in which it is only incidentally within our province to deal, and, as a technical journal, unexcelled in the particular sphere which its title indicates, the ELECTRICAL WORLD does well to be conservative in those directions in which it makes no pretence to be authoritative.

To be conservative, however, in matters in which our limitations make caution expedient, does not necessarily mean that we must be altogether unprogressive. Do we not do well to accept the guidance of those authorities which embody the most recent advances made in the particular field which they rightfully encompass?

It is not to be honestly denied that the changes in our orthography, as recorded by our modern dictionaries, are, in general, in the direction of simplicity and more nearly accurate phonetics, having behind them sound scientific principles and the support of eminent as well as of expert authority. And, as suggested by Prof. Brander Matthews, such changes are as embodied in our modern authoritative dictionaries it would not only be reasonable to adopt, but unreasonable to reject.

You make use in your editorial of the phrase, "So-called simplified spelling," but you do not enlarge on this point of view, and, in fact, it would seem almost unnecessary to point out why the so-called amended forms are justly so called; that is, "simplified," as compared with those of our present obsolescent unsystem of spelling. It may, however, remove a misapprehension, which might arise in the mind of the casual reader of your editorial, to illustrate the point in the words of Mr. Carnegie. Speaking of simplified spelling, he said:

"I convinced one man this afternoon. I told him to write

'tho,' and then ask himself why, as a rational man, he should add 'ugh' to it."

One of our telegraph operators has aptly expŕest the same idea when he remarked, "What's the use of spelling t-h-o and then writing a kind of a grunt after it?"

Perth Amboy, N. J. Tracy D. Waring.

[Is there not danger that in avoiding the Charybdis of involved spelling, the Scylla of ambiguous pronunciation may be encountered? *Carest* for caressed, *ocher* for ochre, *thoro* for thorough and *thoroly* for thoroughly are examples of simplified spelling of more than doubtful value. And if such examples appear in a list manifestly designed as an entering wedge—as a bait—what may not be held in reserve for the future?—Eds.]

Interference with Wireless Messages.

To the Editors of Electrical World:

Sirs—The news item in your recent issue concerning the policeman's son in Washington who takes delight in churning up the ether around the Navy Yard and mocking various distant wireless stations, brings up strikingly the necessity for early legal protection of legitimate workers from such vandals. In this connection there is no wireless reform more needed, so it appears to me, than the necessity of early legislation defining, not the wave-lengths, but the maximum limit of damping of wave-trains which can be permitted in any radio-telegraph station. This factor, damping, is of far more vital import than any regulation of wave-lengths. The damped half-tuned wave is an etheric pirate, and should be prohibited, the world over. I believe the time is not far distant when the operator who sends out strongly damped vibration of even small energy will be penalized by Federal statute. Radio chaos will certainly be the result until such stringent regulation is enforced. The day of the barbarous spark discharge is numbered, and the sooner it is classed with the filings coherer the better.

Not until then can any legislation or intelligent and skilled syntonization prevent woeful interference, however unintentional. Limit all wireless communication to the sustained oscillation methods; and there will be ample gamuts of wave-length to "go around." The bugbear of interference, and much of the discussions in international conventions will be quite unnecessary.

Above all, the ubiquitious amateur with his high-school Ruhmkorf coil, the operator of the "brute force and ignorance" wireless school, must be eliminated. To effect this will not be so difficult as might appear at first blush. The mischievously minded "expert" cannot do much harm so long as he keeps his antenna "hidden under a bushel," and a "wireless detective" with a small portable receiver can readily spot the source of annoyance by a brief scouting expedition. With the rapid spread of radio-telegraphy and telephony legislation and policing will soon be in public demand.

New York City. Lee De Forest.

Leakage Reactance of Induction Motors.

To the Editors of Electrical World:

Sirs—In looking through my article on "Calculation of the Leakage Reactance of Induction Motors," published in your issue for March 30, I find the following errors:

Slot Constants $\frac{b}{3a} - + \frac{c}{a} - + \frac{2h}{ag} - + \frac{e}{g}$

Should be $\frac{b}{3a} - + \frac{c}{a} - + \frac{2d}{ag} - + \frac{e}{g}$

The air-gap should be designated as δ instead of d. q represents the number of poles.

The lower line of Fig. 4 should read: "$\frac{g}{2\delta}$ and slots per pole."

Pittsfield, Mass. I. E. Hanssen.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Combined Series and Repulsion Motors.—E. Danielson.—The author has combined a Latour compensated repusion motor with a switch so that the motor can be used either as repulsion motor or as series motor for direct or alternating

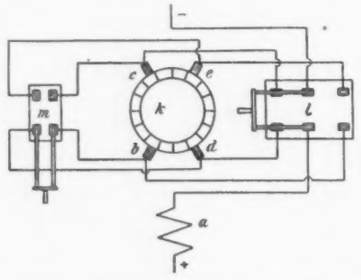


FIG. 1.—COMBINED SERIES AND REPULSION MOTORS.

current. Fig. 1 shows the arrangement. *a* is the stator winding, *k* is the armature, *l* is a switch for reversing the direction of rotation and *m* is a switch which when open, as in the illustration, makes the motor a pure series motor, the brushes *b* and *e* being disconnected. When the switch is closed the brushes *b* and *c* as well as the brushes *e* and *d* are short circuited and the motor becomes a compensated repulsion motor of the Latour type. The author discusses the properties of such a motor and finds that it combines the good qualities of the compensated repulsion motor near synchronism with those of the series motor above synchronism. These properties are thought to be valuable for traction purposes if trains or cars are to be operated with greatly varying speed, for instance, in suburban traffic, etc.—*Elek. Zeit.*, May 30.

Design of Alternators as Influenced by Rated Speed.—H. M. Hobart and A. G. Ellis.—The conclusion of their serial. The present installment deals with machines of large rated output. The leading features of a series of designs are discussed in a similar way to that used with the smaller outputs. The general conclusion arrived at is that there is a certain range of speed for a given rated output and frequency, at which the most economical and best design is obtained. The value of this speed is dependent on the number of poles associated therewith to give the required frequency. In general, the designs for rated outputs up to 3000 k. v. a. are most favorable and economical when the design has a speed corresponding to four poles. For rated outputs higher than 3000 k. v. a. the most favorable speed is that corresponding to six or eight poles, the lower speeds applying best to the larger rated outputs. It is further remarked that, on the whole, steam-turbine speeds are more favorable to alternator designs than to continuous-current designs.—Lond. *Elec. Eng'ing*, May 30.

Interpoles.—F. H. Page and H. J. Hiss.—The first part of an illustrated paper on the present state of direct-current design as influenced by interpoles.—Lond. *Elec. Eng.*, May 24.

Lamps and Lighting.

Hissing Metallic Arc.—W. G. Cady.—An abstract of an American Physical Society paper. The arc between iron elec-

trodes in pure nitrogen was investigated in order to determine whether the presence of oxygen plays the same part in causing the hissing stage of the iron arc as is the case with the carbon arc. It was found that the iron arc in nitrogen resembles the hissing rather than the quiet arc. No quiet state, properly speaking, could be obtained, as the arc went out whenever the current was decreased to the point where the positive electrode ceased to be vaporized. This suggests that the quiet state of the metallic arc may be defined as that in which the material of the anode is not heated to the boiling point. All observations of the iron arc in air, including the rate of consumption of the electrodes, the temperature of the oxide globules as determined by a thermoelement, and the appearance of the spectrum of the arc between iron and copper, tend to confirm this view.—*Physical Review,* May.

Power.

Storage of Energy.—F. LOPPER.—The author discusses the advantages of storing energy during the hours of light load by operating electric motors connected to pumps which raise water to a reservoir at a certain height. At hours of maximum load this reservoir gives off water for operating water-wheels connected to generators. The combined efficiency of an electric motor and pump is about 71 per cent and that of a water-wheel-driven generator has also about the same value, so that the total efficiency is about 50 per cent. Some formulas are given showing how to make the calculations for the size of the reservoir, etc. The application of such a method is suggested for the project of Blondel, Harle and Maebl, for long distance power transmission to Paris.—*L'Ind. Elec.,* April 25.

Utilization of the Rhone Water Power at Paris.—BLONDEL AND HARLE.—A reply to the criticisms which have been made by the Prefect de la Seine on their project of transmitting power obtained from the Rhone River to Paris.—*L'Ind. Elec.,* April 25.

Electric Power in Rolling Mills.—BIGGE.—A long abstract of his Iron and Steel Institute paper recently abstracted in the Digest, together with an account of the discussion which followed its reading. Many speakers estimated that the cost per ton of metal rolled would be far greater with electric driving than with direct driving by means of modern steam engines, but in support of the electrical system it was contended that no allowance had been made by its opponents for the gain in load factor, and the consequent great reduction in the capacity of the power plant required.—Lond. *Elec. Eng'ing,* May 30.

Steam Power.—W. D. ENNIS.—The first article of a serial on efficiency in the burning of fuel under the steam boiler. The influence of the air supply upon the economy of combustion is discussed and the control of the losses of heat as indicated by flue gas analysis is pointed out. Several recording devices for this purpose are described.—*Eng'ing Mag.,* June.

Traction.

Car Meter.—W. WATTMANN.—A translation of his report presented before the International Association of Tramways and Light Railways on the use of car meters in continental Europe. The author discusses the value of such meters as a check on the ability of the motormen. The meter used may be an ordinary electric energy meter, but a much cheaper and simpler instrument consists of a clock which registers the time during which energy is supplied to the car. An example is given showing how the price of energy decides to some extent the type of meter to be used. This report is supplemented by the diagram showing the economies effected at Frankfort by the use of such meters. The records of energy consumption are given for the corresponding months of two succeeding years. In the first year no meters were used and in the second they were introduced. The saving in electric power shown in the two curves is very remarkable. The meter used on the tramways of Frankfort is shown in Fig. 2. It consists of a clockwork arrangement driven by a spring. The clockwork runs down in about 300 hours and is wound up by hand. As the meters operate for only about a third or fourth part of the total traveling time, the clockwork will go without winding for about 45 working days of 20 hours each. Automatic electric winding was considered superfluous and a wholly undesirable complication. The meter is provided with hour and minute hands and the dial is divided in the ordinary way. The balance wheel, which is usually locked, is released by the armature of an electromagnet as soon as current flows through the winding of the latter. If the electromagnet is connected directly in the motor circuit, its pull decreases with the current, and for this reason it would have to be provided with turns

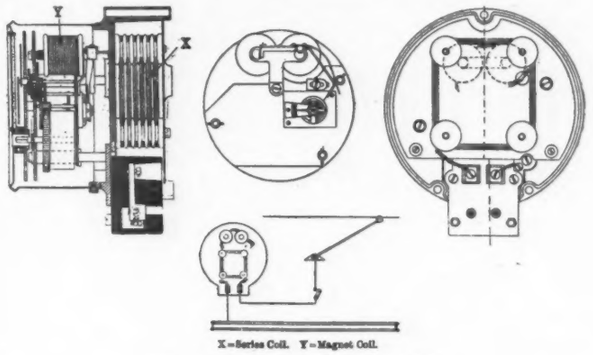


FIG. 2.—DIAGRAMS OF CAR METER.

sufficient to act with a weak current, while the car is running down hill. The restricted space, and the fact that it is easier to fix apparatus with small conductors, caused the electromagnet to be fitted with a high resistance winding. The pull of this electromagnet is so arranged that the meter is cut in or out with certainty when the voltage is between 350 and 600. The electromagnet winding and series resistance are in parallel with the main circuit containing the motor and starting resistances. As soon as the motorman switches on, the electromagnet not being dependent on the controller notches, will be excited by a constant current, the armature will free the balance wheel and the meter will come into operation. When the circuit is broken the armature relocks the balance wheel. The clockwork movements are surrounded by a dust-tight case, which is earthed to avoid accidents arising from a failure in the insulation. The meter is fixed in a corner inside the car, so that the position of the hands can be read off from the interior of the car or from the driver's platform. Only one meter is necessary for each car.—Lond. *Elec.,* May 31.

Installations, Systems and Appliances.

Commercial Development of Central Stations.—A. BAUMANN.—The first part of an article in which the author discusses the influence of technical progress—especially in the invention of new high-efficiency incandescent lamps—on the commercial development of central stations. With the new commercial metallic-filament lamps, the cost of electric lighting has been reduced to one-half, and there is hope for a further reduction. Moreover, in comparison with gas lighting the possibility of placing an electric lamp in any position and using better reflectors involves a distinct superiority over the gas incandescent lamp. For instance, for the illumination of a table a 65-cp gas incandescent mantle consuming 120 liters of gas per hour may be replaced by a 32-cp electric incandescent lamp with reflector and consuming 40 watts. This shows that the costs of the two are equal if the kw-hour costs three times the price of the cubic meter of illuminating gas, which relation is now often obtained in practice. Under these circumstances a greatly extended use of electric lighting is to be expected. Since the feature of the new lamps is rather more light than less consumption of power per lamp, it is not probable that the amount of power consumed for lighting will decrease. But the introduction of 32-cp incandescent lamps with smaller power consumption than that of the old 16-cp lamps is equivalent to a considerable reduction of the price of energy for lighting. A further reduction of the rate charged by the central stations for energy for lamps is therefore not to be expected. The in-

troduction of improved lamps may rather be expected to increase the maximum load of the stations so that the necessity of equalizing the load curve will manifest itself more and more. It is recommended to reduce the rate charged for energy considerably during day hours so as to increase the consumption for motor purposes, and it is strongly recommended to push the use of electric energy for various heating purposes. Some of these applications are so advantageous that even if the station is operated by steam electric heating can be made to compare favorably with gas heating. The article is to be continued.—*Elek. Zeit.*, May 30.

Permanent-Leak Water Lightning Arrester.—L. W. Dixon.—A description of a water lightning arrester recently installed by a British company to cope not only with static discharges and disturbances, but if possible with atmospheric discharges, although the success with respect to the last point has not yet been decided. Two horizontal water pipes are provided, the flow and the return, connected respectively with the neutral of the generators and the station earth plate. To the "flow" and "return" there are connected vertical pipes of glass tube jointed at the top to a special piece of glass tubing shaped like an inverted U, having a glass bulb in the center, into which the point of the line wire dips, being made water-tight at this point by a conical plug of india rubber. The flow and return through this loop of glass tubing represents the maximum resistance for one of the three lines, being approximately 700,000 ohms, which at the nominal pressure of, say, 6800 volts that exists on the system, between line and earth, will give a leakage of about 0.01 ampere. The resistance in the three sets can be conveniently altered if necessary by connecting up to earth any one of the rows of metal sockets which form the joints of the glass tubing.—Lond. *Elec.*, May 24.

Wires, Wiring and Conduits.

Fuses.—A description of some new fuses of Paard. One of them is of a non-explodable steel-cased tubular pattern.—Lond. *Elec.*, May 24.

Electrophysics and Magnetism.

Electric Waves.—C. Schaefer.—Criticisms of a former paper by F. C. Blake and C. R. Fountain on the reflection and transmission of electric waves by a resonator grating.—*Physical Review*, May.

Units, Measurements and Instruments.

Hot Wire Wattmeters and Oscillographs.—J. T. Irwin.—A paper read before the (British) Institute of Electrical Engineers on a new type of hot-wire instrument which can be used for measuring voltage, current and power, and is also adapted for use as an oscillograph and for recording magnetizing curves. In Fig. 3 CD and EF are two wires or strips of the same size;

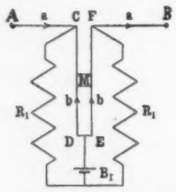
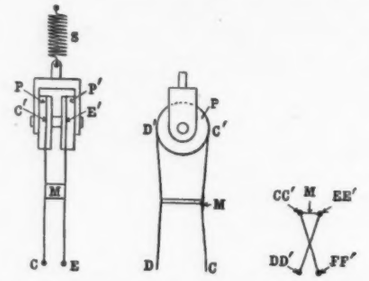


FIG. 3.—HOT WIRE WATTMETERS AND OSCILLOGRAPH.

one pole of the battery B_1 is applied to DE, and the other pole of the battery is connected through two resistances, R_1R_1 to C and F. If the resistance of CD is equal to $EF = r$, (say), then there will be a current b, in each wire. If another current, a, from any other source is sent from C to F through both the wires in series, the whole current a can be assumed to pass through the strips CD, EF, owing to the resistances R_1R_1 being large compared with the resistance of the strips. Then the rate of heating in the righthand wire will be $(a+b)^2 r$, and the rate of heating in the lefthand wire will be $(a-b)^2 r$. In any case, the difference in the rates of heating is proportional to $4abr$. Therefore, if b and r are constant, the difference in the rates at which energy is given to the two strips is proportional to the current a, and if the current a reverses in sign, the difference will reverse in sign. If the wires CD and EF are each drawn back with equal and constant tension at their middle point. then a small mirror M, placed across the two wires, will be deflected through a certain angle proportional to the difference in temperature between the two wires and this difference in temperature is proportional to $4abr$ if the current a remain constant for some time. Therefore, one has a polarized instrument in which the deflection for small angles is practically proportional to the current. The author had some difficulty in devising a method to draw back the two wires with equal and constant tension. He finally adopted the following arrangement: The wires CD and EF in Fig. 3 instead of being pulled back at their middle point pass over independent and insulated pulleys P P^1 and return almost parallel to each other and to their outgoing length as shown in Figs. 4 and 5, where the



FIGS. 4, 5 AND 6.—HOT WIRE WATTMETERS AND OSCILLOGRAPHS.

wire $C\,C^1\,D^1\,D$ correspond to the wire CD in Fig. 3. A similar wire $E\,E^1\,F^1\,F$ will pass over the pulley P^1; these two systems of wires are tied together diagonally; that is, the wire $C\,C^1$ is tied at its middle point to the middle of the wire F^1F and the wire $E\,E^1$ it tied back at its middle point to the middle of D^1D. This is shown in Fig. 6. Now as the current passing through the wire $C\,C^1$ is the same as that passing through D^1D if they are of the same length and of the same size, the expansion of each wire will be the same since the rate of losing heat is the same. The pulley P will not rotate and will only serve to ensure that there is equal tension on each wire. The pulleys $P\,P^1$ are drawn up by the spring S. If there is no current in $C\,C^1$ $D^1\,D$ or $E\,E^1$ $F^1\,F$, and if the wires are exactly similar at the same temperature, then the sag of the wires $C\,C^1$, $D^1\,D$, $E\,E^1$, and $F^1\,F$ will be equal in each case. If a current is sent through the four portions in series, then there will be an increase in length in all four wires, but there will be no deflection of the mirror. If the wire $C\,C^1$ $D^1\,D$ is heated it will sag more than the wire $E\,E^1$ $F^1\,F$, and therefore the mirror will be tilted by an amount depending on the difference in the rates of heating in the two wires. Curves are given to show that the relation between deflection of the instrument and current is represented by a straight line, if the "exciting" current sent through the two strips is constant. This latter requirement seems an objection to the general use of the instrument, but it has distinct advantages for special purposes, namely, when it is necessary to measure the instantaneous voltage across two points or the instantaneous current in a circuit. The solution of this problem seems very difficult on account of the natural sluggishness of the hot-wire system and the fact that it is losing heat at a rate dependent on the temperature. This difficulty is overcome by combining the instrument with a condenser shunted by a resistance for pressure measurements and with a self-induction for the measurment of current. Regarding the heated strips as very leaky thermal condensers, they are compensated by an electric condenser which is made appropriately leaky by a resistance in parallel with it. The paper is to be concluded.—Lond. *Elec.*, May 31.

Flicker Photometer.—J. S. Dow.—A description of some experiments intended to investigate the connection between the sensitiveness of a flicker photometer and the speed at which the flicker disk is driven. A distinction is drawn between the photometric comparison of sources of light which are similar in color and heterochromatic photometry. In the first case, a wide

range of speed is permissible. But if the illumination of the photometer disk is very low this range is reduced and the sensitiveness of the photometer also becomes less. Curves are given showing the percentage variation of illumination detectable by the photometer as a function of the frequency of the flicker; that is, the number of times the photometrical surface presented to the eye is changed per minute. For illuminations above 10 candle meters or so, the curves at different illuminations begin to coincide and the sensitiveness of the photometer is in each case maintained at its maximum value over a range of frequency of about 450 to 1100. For illuminations below about five candle meters the higher speed becomes inadmissible, the range of frequency over which maximum sensitiveness occurs is more restricted, and also the sensitiveness itself becomes less. Indeed, according to the author's experience the flicker photometer seems to require an illumination of at least two candle meters to be operated at all satisfactorily. In view of the relatively large range of frequency over which the sensitiveness is at its best it is easy to select a satisfactory speed. When comparing illuminants differing widely in color, for instance, when comparing green light with white light, a higher speed is required and the satisfactory range of speed is much more restricted. It is, therefore, not so easy to strike the exactly correct speed as in the former case and some practice enables one to find it without much difficulty. For an illumination of 20 candle-meters, for example, when comparing green with white light, the frequency should lie between 1200 and 1400. Finally the author points out that very great exactness cannot be expected from such experiments. It is the author's experience that the sensitiveness of the eye to a flicker is easily altered and is particularly susceptible to the effects of fatigue so that results obtained on different days differ somewhat.—Lond. *Elec.*, May 31.

Wave Meter.—ARMAGNAT.—A description of the wave meter of Ferrié exhibited at the annual exposition of the French Physical Society. This instrument is a resonator, the characteristic feature of which is the means employed to vary the self-induction. It is known that the apparent self-induction of a circuit through which an alternating current or electric oscillations pass varies when induced currents are produced in circuits in the neighborhood. In the wave meter of Ferrié the principle of which is shown in Fig. 7, the circuit 3 has a variable self-induction, being placed within a copper tube *B A B*¹ which is almost of closed circular form. By means of the lever *M* which slides on the copper tube it is possible to change the surface and the resistance of the copper tube in which secondary currents are induced so that the induced currents have a variable intensity according to the position of the lever *M*. In the wave meter which was exhibited for medical purposes the copper tube has a diameter of 1 cm and is bent so as to form a ring, almost closed, of 25 cms diameter. It encloses 20 turns of wire indicated in the diagram by the dotted circuit 3. By adjusting the position of the lever *M* it is possible to reduce the apparent self-induction of the circuit 3 in the ratio of one to one-eighth or one-ninth. The complete wave meter consists of the adjustable resistance *B A B*¹, the circuit 3 in series with the condenser *C* and the hot-wire ammeter, indicated in the diagram by the word "thermique." An intermediate circuit, 2, transmits by induction the effect of the circuit 1 (through which the current under test passes) to the circuit 3 of the resonator. The instrument is calibrated empirically. For medical purposes the frequencies vary from 450,000 to 2,000,000 periods per second of the wave lengths from 660 to 150 meters. The hot-wire instrument serves only for observing the maximum current.—*L'Ind. Elec.*, May 10.

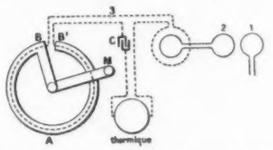


FIG. 7.—DIAGRAM OF WAVE METER.

Electrolytic Selenium Cell.—A note stating that M. Reinganum has succeeded in constructing a selenium cell in which the illumination, furnished by three Nernst filaments, increases the current 27 times. Selenium is spread evenly over a piece of platinum foil covered on the other side with asphalt varnish. It is immersed in a 3-percent solution of sulphurous acid, the other electrode being another piece of platinum foil with its plane at right angles to the first, thus allowing the full illumination. The light is concentrated by a lens upon the selenium. When the selenium electrode is charged positively there is some decomposition, and the deflection produced by illumination is soon reduced by polarization. This also occurs when the selenium is negative, but at a different potential (0.5 volt). At this point there is a maximum absolute increase of current, the amount being as stated above. At smaller voltages the relative increase is even higher, since the current in the dark is much feebler. At higher voltages the current in the dark becomes inconveniently strong. All action of light disappears when the voltage in either direction is as high as 1.4. Positively charged selenium shows an increase of current at 0.6 volt, but a decrease at 0.4 and 0.5 volt. The author believes that the principal action of the light is confined to the selenium and is not electrolytic.—Lond. *Elec. Eng'ing*, May 30.

Electric Method of Testing the Cross-Section of Wire Rope.—A note on a method for obtaining electrically the cross-sectional area of wire ropes. The arrangement, which is specially adapted for use on haulage ropes in mines, consists of a transformer whose primary is connected to an alternating supply, while its secondary is in series with an ammeter and a coil, wound on a hollow bobbin; this coil is placed round the rope whose cross-section is to be determined. The self-induction of the secondary circuit is low when the rope is not passing through the hollow coil, but rises on its insertion, producing a decrease in current in proportion to the self-induction produced. For a particular coil, a 1⅛ in. rope brought down the current from 220 to 120 amperes, and for every 1 per cent alteration in the mass of the rope the current varied 1 ampere. The instrument can be calibrated for any particular size of rope as required, and it is intended that the coil should be kept permanently round the haulage rope, so that any decrease in the diameter can be noticed at once. This method was suggested by C. McCann before the Transvaal Institute of Mechanical Engineers.—Lond. *Elec.*, May 31.

Instruments.—H. ARMAGNAT.—An account of various instruments shown at the annual exhibition of the French Physical Society. Different recording attachments were exhibited by Carpentier, Siemens & Halske, Hartmann & Braun, J. Richard and Champin and Arnoux. Several ammeters and wattmeters are also described. Among the wattmeters exhibited there were three induction instruments with recording attachments, while the other two were direct-reading electrodynamic wattmeters. Various meters, the projection rheograph of Abraham and Carpentier, the wave meter of Ferrié, the radiopyrometer of Ferrir, the "radiosclerometer" of Willard and various constructions of induction coils are also described.—*L'Ind. Elec.*, May 10.

Time-Meter for Trolley Cars.—See the abstract under Traction.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—FLEMING.—An account of his lecture before the Royal Institution on recent contributions to electric-wave telegraphy. He spoke especially on three known methods of producing undamped oscillations of high frequency. The first is by means of high-speed alternators with many poles, but the mechanical difficulties of this system have not yet been overcome. The second is the musical-arc method recently perfected by Poulsen. The lecturer showed an experiment which appeared to demonstrate that the Poulsen oscillation-generating apparatus is not yielding a perfectly uninterrupted train of oscillations. This was made visible by black lines within a luminous area produced by a glowing neon tube excited by the waves. "Prof. Fleming added nothing to the commonly ac-

cepted scientific explanation of the production of the oscillations by the arc method, which rests on the fact that rise of arc p. d. is always associated with fall of arc current. He indicated, however, that a series of experiments on the cooled-copper carbon arc, conducted in his own laboratory, proved that the characteristic curve (p. d. and current) of such an arc falls much more steeply than does the characteristic of the carbon-carbon arc—which goes a long way to explain Poulsen's success in reaching high frequencies with practical power output. Commenting on the relative positions of arc and spark telegraphy in the world of practice, Prof. Fleming, speaking from his own experience with both methods, expressed the opinion that the greater difficulty of erecting and adjusting the arc apparatus and in keeping it running, together with the narrow limits, as regards the practical size of a unit (nothing much less or much greater than two horse-power being workable), would long enable the spark method to maintain its position." The third method to which the lecturer referred is a new one for generating undamped oscillations, and is being developed by Marconi. No description was given except that neither spark nor arc alternator is used in it. The lecturer also showed a new form of sender and receiver devised by himself. "In this system the sender and receiver consist of closed circuits, both earthed. The sender is excited by undamped oscillations, and the apparatus bears to a radiator discussed by Fitzgerald a relation similar to that which Marconi's original form of radiators bears to that of Hertz. The signals are made by breaking and making the earth connection of the transmitter in accordance with the Morse code. When the earth connection is made at both ends, a sound is heard in a telephone in a branch circuit of an oscillation valve, but no sound is heard when the connection is broken. This seems to depend on the fact that the oscillations produced by the arc method are not absolutely continuous, but are cut up into groups as already shown in the Neon tube experiment." A few remarks were made on wireless telephony.—Lond. *Elec. Eng'ing*, May 30.

Telephone Transmission Measurements.—A full account of the long discussion which followed the paper of Cohen and Shepherd on telephone transmission measurements recently abstracted in the Digest. Duddell showed a number of oscillograms of consonants, and demonstrated by actual experiment on an artificial line the shapes of the transmitted and received waves of current. He also briefly alluded to a method of reproducing speech from the oscillogram films so taken, and stated that he had succeeded in making a pivoted thermal milliammeter. Gill urged that greater attention should be devoted to telephony in technical colleges, and paid a tribute to the work of Oliver Heaviside.—Lond. *Elec. Eng'ing*, May 23.

Telephony by Means of Transmission Cables.—R. Hiecke.—In electric plants with several generating stations or with large consumers at a distance, telephone communication between the different plants is important. If the transmission is by overhead wires, the telephone lines can easily be placed on the same poles. If the transmission lines are underground cables it is possible to utilize the cable and its testing wires for telephony. The author describes an arrangement for direct-current networks in which he uses the testing wire of a cable for telephone transmission, with the core of the cable as return circuit. Different arrangements are necessary according to whether the testing wire is used for voltage measurements or not. If it is used for voltage measurements use must be made of a special transformer, the design of which is described.—*Elek. und Masch.*, May 19.

Miscellaneous.

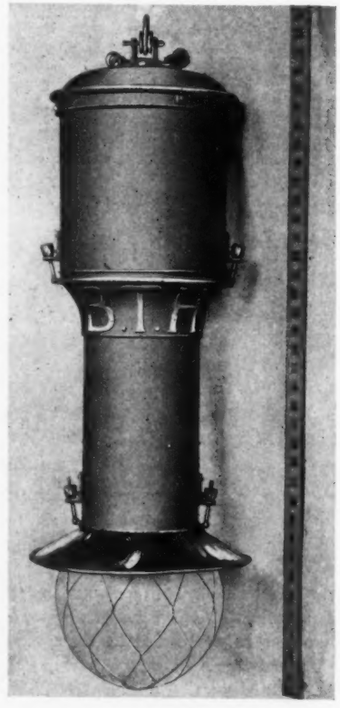
Fires Caused by Electricity and Gas.—G. Dettmar.—An article giving statistical data on fires caused by gas and electricity. It is shown that the statistics compiled by the Association of German Fire Insurance Companies are not reliable. On the basis of further statistical material it is estimated that from 0.15 to 0.20 per cent of all fires are caused by electricity and from 0.23 to 0.40 per cent directly by gas. However, the gas lighting industry is indirectly responsible for a greater number of fires since it requires the use of matches, which are far more dangerous than the gas itself. Of all fatal accidents in Prussia 0.2 per cent are due to electricity. It is wrong to consider gas as safer than electricity.—*Elek. Zeit.*, May 30.

Danger from Direct Current and Alternating Current.—H. Danneel.—A discussion of the question why alternating current is less dangerous than direct current. The physiological effect of the current appears to depend rather on the quantity of electricity (the coulombs) than on the current (amperes). The electrolysis of the salts in the body has to do with the physiological effect. The author thinks that the well known experiment showing the lack of danger from Tesla currents is not due to the skin effect, but is rather due to the fact that any electrolytic effect produced by one half-wave is quickly reversed by the next half-wave. Some measurements of Nernst concerning this point are summed up.—*Elek. Anz.*, May 16 and 23.

Laboratory.—An illustrated description of the new engineering laboratory of the South Africa College in Cape Town.—Lond. *Elec. Eng'ing*, May 23.

British Flame Arc Lamps.

The British Thomson-Houston Company, Rugby, England, has placed upon the market a line of flaming arc lamps suitable for either direct or alternating current. As will be noted from the accompanying illustration, the lamps are weatherproof and dust-proof; they may be used for inside or outside illumination. The feeding mechanism is strong and simple, there being neither clockwork nor spiral springs. The pencils are arranged at an acute angle and fed forward by gravity.



BRITISH FLAME ARC LAMP.

Use is made of the differential method of control, with shunt and series magnets. The wire of the shunt magnets is insulated with enamel which does not deteriorate with heat or moisture.

The pencils are of impregnated carbon, the materials being selected to produce yellow light. The life of the pencils depends upon their length. The lamps are made in two lengths, the one with 24-in. pencils burns 17 hours, while one with 16-in. carbons burns 10 hours. Each lamp of a series consumes 50 volts; the current is 8 amperes direct or 10 amperes alternating at 50 cycles.

Electric Grinders and Hoists.

The well-known line of Duntley electric drills and reamers has now been extended to include electric grinders and hoists, illustrations of which are shown herewith. The grinders are made in two distinct types, one for portable use and the other for use in machine tools, these being known as "Tool Post" grinders. The portable grinders are made in two sizes taking 5-in. and 8-in. wheels respectively. They consist of a light portable motor of generous capacity, driving the emery wheel at the

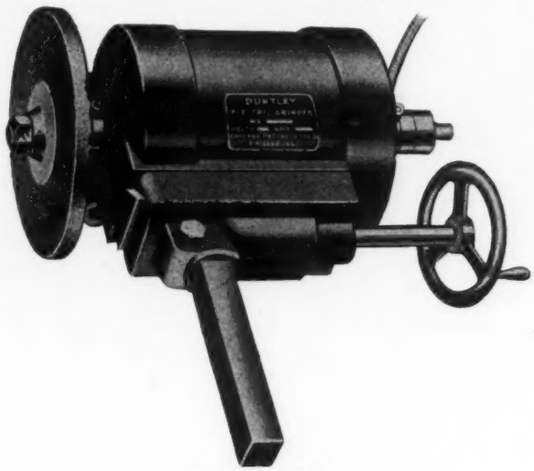


FIG. 1.—GRINDER.

speed of the armature, which is so proportioned to the diameter of the wheel as to give the proper cutting speed recommended by the manufacturers of the best emery wheels. These tools are finding a wide field in all classes of metal work, the larger grinder being especially adapted for grinding rough castings or wherever heavy duty is required.

The tool-post grinders are made in three sizes, taking wheels 5, 8 and 10 ins. in diameter, respectively. The electrical parts have been designed along the same lines as the well-known Duntley electric drill. The grinding arbor is of steel and runs in bronze bearings which are self-lubricating. These grinders

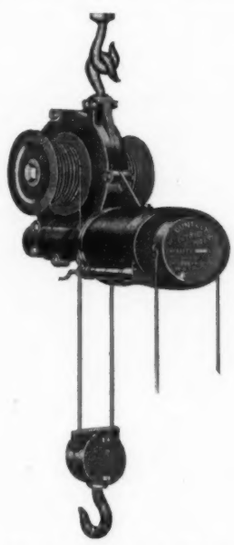


FIG. 2.—PORTABLE HOIST.

are provided with tapered steel bushings driven by the shaft and running in phosphor-bronze bearings fastened to the housing of the grinder. Any of these parts can be easily replaced and no part of the motor housing itself is used as a bearing. The grinders are provided with dust-proof collars, keeping the emery out of the winding and bearings. The tools are light in weight, but they will develop a sufficient amount of power to do their work without excessive heating. They can be adapted for internal grinding or mounted on a pedestal if desired for stationary work.

The Duntley portable electric hoists are made in sizes from 250 lbs. up to 2000 lbs. capacity. In designing these hoists it has been the purpose to make a light portable hoist, and with this end in view a special motor has been designed for each size, and no attempt has been made to use the same motor on all sizes. The advantage of this is obvious, as no unnecessary weight is put on the hoist, and ample power is provided for doing the work of each in accordance with its rating. These hoists are of the worm-gear type, with two hoisting drums, one located on each side of the gear. The worm is provided with roller thrust bearings and runs in oil. It is driven through a planetary system of gearing similar to that used in the electric drills. A very simple dynamic brake is used, by means of which the hoist can be stopped instantly, either in going up or coming down with full load. The control is located at the outside end of the motor, and is handled by means of two cords running within reach of the operator. The hooks are provided with a ball-bearing swivel. The standard drums are arranged for a lift of 15 ft., and are sufficiently wide so that only one wrap of the cable is necessary on the drum. Where no greater lift is desired, the drums are widened out, and can be furnished capable of lifting up to 25 ft.

The tools are manufactured by the Chicago Pneumatic Tool Company, Chicago, Ill.

Tungsten Series Lamps.

The General Electric Company announces that it is ready to supply tungsten lamps for series street lighting. The high efficiency now obtained by the tungsten lamp will enable central station companies to compete successfully with other forms of street illuminant of low or moderate candle-power. It is particularly adapted to series lighting service, as the low voltage permits the use of short, stable and durable filaments. The lamps will be supplied in 40 and 60 candle-power in 4, 5.5, 6.6 and 7.5 amperes. Forty candle-power is considered the minimum desirable candle-power for this class of illumination. Present 3.5-ampere systems can increase their current to 3.8 and 3.9 and thus come within the 4-ampere range.

Combination Switch Boxes.

The accompanying illustrations show a line of steel switch and receptacle boxes designed for use in connection with concealed wiring of either the knob-and-tube or the conduit type. Fig. 1 shows a two-gang box which is the unit for sectional gang boxes intended for conduit work. The length of the boxes may be increased indefinitely by removing the screws holding

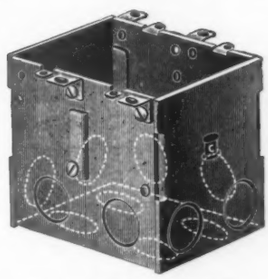


FIG. 1.—TWO-GANG BOX.

FIG. 2.—SPACER.

the two portions together and inserting any number of the spacers shown in Fig. 2. The line includes, also, boxes provided with openings for the entrance of flexible tubing, and boxes in which the four walls are formed of one piece with a dove-tailed joint. These boxes are manufactured by the Chicago Fuse Wire & Manufacturing Company.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Some improvement in conditions in a wide area was reflected during the week in a more optimistic tone in the reports of the general business situation to the leading commercial agencies. The crop outlook also is decidedly better. Though the retail trade has been put to the necessity practically all over the country of clearing out stocks of summer apparel by means of bargain sales, the prospects are reported encouraging for a heavy business in the fall. Mercantile collections are below normal. The cotton mills have contracts assuring activity far into the future. Railway earnings are 12.8 per cent larger than in June, 1906, while foreign commerce at the port of New York for the week showed a gain of $4,953,424 in imports, and a loss of $1,066,432 in exports, as compared with the same week last year. Bank exchanges at New York for the week were 10.7 per cent less than last year, but at other leading cities there was an average gain of 11.8 per cent. Reports from the leading industries partake of the prevailing irregularity. Finished iron and steel are active, structural material leading, while pig iron is quiet. Production of pig iron continues making new records without depressing prices. In lumber, interior buying at large Western centers is less active, and Oregon logging camps have shut down to avert lower prices. Some Southern markets report declining prices for lumber, a reflection, apparently, of weather or other conditions affecting building. Inability to easily obtain money is the cause assigned for difficulties reported by building concerns who were expanded too "thinly" for the capital employed. Lake copper remains steady at the prices of the previous week, but electrolytic is a trifle lower. Quotations are 24c. for lake; 22¾c. for electrolytic, and 21¾c. for casting stock. *Bradstreet's* reports 161 failures in the United States during the week, against 155 for the previous week, and 170 for the corresponding week of 1906.

BELL TELEPHONE ENGINEERING.—Advices from Boston financial quarters say: "The ultimate removal of the engineering department of the American Telephone & Telegraph Company from Boston to New York was foreshadowed two years ago when the instrument business was centralized in New York. Previous to that time instruments had been shipped from Boston. At present the instruments are manufactured by the Western Electric Company at its New York plant and all tests and laboratory experimental work conducted by the American Telephone engineers are carried on in New York. The removal of the entire engineering forces of the company to New York will carry with it a more or less complete reorganization of the department. Chief Engineer H. V. Hayes has already presented his resignation to take effect July 1. He will probably be succeeded by J. J. Carty, now chief engineer of the New York Telephone Company, and also of the four or five other Bell subsidiaries which are managed in New York. President Vail describes the removal of the engineering department as a 'trifling, functional detail.' Its chief benefit will be a gain in facility and economy of operation. All engineering specifications will, of course, be referred to the executive officers of the company in Boston for final approval and all expenditures will as at present require the approval either of the directors or officers of the company."

THE WEST KOOTENAY POWER COMPANY has the distinction of being the second largest concern of its kind in Canada. Its head offices are at Rossland, British Columbia, and Lorne Campbell is general manager of the concern. The company has three power houses, two of which are at Bonnington Falls and the third at Cascade Falls on the Kettle River. Power house No. 1 is situated at the Lower Bonnington Falls and has a capacity of 4000 hp. No. 2 is at the Upper Bonnington Falls and has been developed hydraulically for 32,000 hp. No. 3 plant has a capacity of 4000 hp. The current is transmitted from No. 1 plant to Rossland and Trail at 20,000 volts; from No. 2 to Rossland, Grand Forks, Phoenix and Greenwood at 60,000 volts and from No. 3 to Phoenix and Greenwood at 20,000 volts. These systems are throughout alternating current, 3 phase, 60 cycle. The motor capacity of the three plants is 18,000 hp., all of which is being used by the mines and smelters in the vicinity of the plants. The company has a 60,000 volt transmission line 82 miles in length, while the total mileage of single pole lines is approximately 300 miles. There is room for plenty of development work at all of the plants, and experts estimate that Upper Bonnington Falls are capable of development to the extent of 72,000 hp when necessary. As the country grows up more power will be developed from time to time at each of the company's plants.

GENERAL ELECTRIC FREIGHT.—A complaint of general interest and importance has been filed with the Interstate Commerce Commission. It is that of the General Electric Company and the Edison General Electric Company of Schenectady, N. Y., against the New York Central & Hudson River Railroad Company and the Delaware & Hudson Company. The complaint alleges that they do a business aggregating $35,000,000 annually, employ 15,000 men, have a plant covering 135 acres, and that it requires 50,000 cars annually to carry their freight business. Because of the refusal of the railroad lines to afford them facilities for switching, placing and loading and unloading of the cars—facilities ordinarily supplied by common carriers to shippers—they are obliged to supply these facilities, in the way of locomotives, tracks, fuel and labor, themselves at great expense. It is alleged that last year the complainants paid out $134,609 in charges of this kind. They ask the commission to issue an order requiring the defendant lines to pay them for the charges which properly belong to the carrying lines.

FOREIGN TRADE FIGURES.—The country's foreign trade statement for May just published by the Bureau of Statistics of the Department of Commerce and Labor makes a rather poor showing compared with recent months. The value of merchandise exported in the month was $134,607,000, the smallest since August; imports, which were valued at $126,606,000, showed a substantial decrease from the totals of March and April. Compared with the returns of a year ago, however, imports for the month showed an increase of $21,697,000, while the gain in exports was but $4,059,000. This reduced the month's trade balance to $17,638,000 under that of a year ago, to the smallest since last July, and the smallest of any May in ten years. The eleven months' totals are by far the heaviest on record. The gain in imports, however, has been much more rapid than in exports. The total exports for the eleven months were $1,742,909,210 and the imports $1,322,005,432, leaving a trade balance in our favor of nearly $421,000,000.

CALIFORNIA IMPROVEMENTS.—The Berkeley (Cal.) Electric Lighting Company, branch of the Oakland Gas, Light & Heat Company, has announced extensive improvements soon to be made in Berkeley, including the erection of a $150,000 electric sub-station. The new sub-station will cover nearly the entire block. A new 250-kw plant will be put in. The erection of the plant has been made necessary because of the heavy demands for electrical energy in Berkeley. Mr. John H. Pape, who has been connected with electric lighting in Berkeley for 19 years, will be the superintendent of the new station.

ALLIS-CHALMERS ROADS.—Note is made of the fact that although the Allis-Chalmers Company has not been very seriously or generally thought of as in the electric railway field, it has already equipped six traction systems with 318 miles of line, of which 150 miles are already in operation. These systems, already noted in our pages, include Allis-Chalmers generators, transformers, car motors, etc.

WESTERN ELECTRIC.—President Barton, of the Western Electric Company, says that while about 5000 hands have been laid off, in Chicago, chiefly, half will be back before the fall. Outside of Chicago and New York the company is employing more help than ever before.

Financial Intelligence.

THE WEEK IN WALL STREET.—Extreme dullness prevailed in the stock market. While sentiment tended to improve on more favorable crop reports, as well as on Gov. Hughes' veto of the 2-cent fare bill and the abandonment of the threatened prosecution of the Union Pacific financiers by the government, bearish influences were furnished by the commencement of suit against the anthracite combination, and by the hardening of money rates, consequent on the Treasury's call for the return of $30,000,000 of government deposits by the banks. Higher money, however, delayed gold exports, although exchange was very strong. At the end of the week the market was very dull and little business was transacted. Traction stocks were weak, Interborough-Metropolitan being particularly conspicuous in this respect. Electric securities were also inactive and closed with losses on the week's business. American Telephone & Telegraph suffered the heaviest decline, closing quotation being 104½, which represents a net loss of 15½ points, ex div. The curb market for the most part was easier compared with the previous week, but there were few strong stocks. Chicago Subway rose 5 points. Following are the closing quotations of June 18:

NEW YORK.

	June 11	June 18		June 11	June 18
Allis-Chalmers Co.	10¼	9½	General Electric	140	137
Allis-Chalmers Co. pfd.	31	27⅛	Hudson River Tel.	—	—
Am. Dist. Tel.	—	—	Interborough Met. Com.	16	16
American Locomotive	57¾	56¼	Interborough Met. pfd.	46	44½
Amer. Locomotive pfd.	102	103	Mackay Cos.	—	—
American Tel. & Cable.	75	75	Mackay Cos pfd.	—	—
American Tel. & Tel.	—	—	Marconi Tel.	—	—
Brooklyn Rapid Transit.	53½	52⅜	Metropolitan St. Ry.	—	—
Electric Boat	33	33	N. Y. & N. J. Tel.	—	—
Electric Boat pfd.	80	80	Western Union Tel.	80	79
Electric Vehicle	—	—	Westinghouse com.	142½	142
Electric Vehicle pfd.	—	—	Westinghouse pfd.	—	—

BOSTON.

	June 11	June 18		June 11	June 18
American Tel. & Tel.	108¾	104½	Mass. Elec. Ry. pfd.	56	—
Cumberland Telephone.	106⅝	—	Mexican Telephone	—	2
Edison Elec. Illum.	208	206	New England Telep.	112	112
General Electric	—	139	Western Tel. & Tel.	—	—
Mass. Elec. Ry.	—	18	West. Tel. & Tel. pfd.	—	—

PHILADELPHIA.

	June 11	June 18		June 11	June 18
American Railways	48	48	Phila. Electric	8⅛	8
Elec. Co. of America	9½	9⅜	Phila. Rapid Transit	23½	23¼
Elec. Storage Battery	48	48	Phila. Traction	91⅞	92½
Elec. Stor. Battery pfd.	—	—			

CHICAGO.

	June 11	June 18		June 11	June 18
Chicago City Ry.	150	150	National Carbon	70	71
Chicago Edison	—	—	National Carbon pfd.	110	110
Chicago Subway	20¼	23	Union Traction	—	—
Chicago Tel. Co.	—	120	Union Traction pfd.	17	—
Metropolitan Elec. com.	22	20			

DIVIDENDS.—Directors of the Providence (R. I.) Telephone Company have declared a regular quarterly dividend of $1 per share, payable July 1. Directors of the Bangor Railway & Electric Company have declared the regular quarterly dividend of 1¼ per cent, payable July 1. Directors of the Louisville Traction Company have declared the regular quarterly dividend of 1 per cent, payable July 1. Directors of the Rochester Railway Company have declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable July 1. Directors of the Columbus (Ga.) Electric Company have declared the regular semi-annual dividend of 3 per cent on the preferred stock, payable July 1. Directors of the Ridge Avenue Passenger Railway Company, Philadelphia, have declared a dividend of $3.25 per share, payable July 1. Directors of the Manila Electric Railroad & Light Corporation have declared a semi-annual dividend of 1 per cent on the capital stock, payable July 1. Directors of Reading Traction Company have declared a dividend of 75 cents per share, payable July 1. Directors of the Cumberland Telephone & Telegraph Company have declared the regular quarterly dividend of 1¾ per cent, payable July 1. Directors of the United Gas Improvement Company have declared the regular quarterly dividend of 2 per cent, payable July 15. Directors of the Cincinnati Street Railway Company have declared the regular quarterly dividend of 1½ per cent, payable July 1. Directors of Westinghouse Machine Company have declared the regular quarterly dividend of 2½ per cent upon the capital stock, payable July 10 to stockholders of record on July 1. Directors of Westinghouse Air Brake Company have declared the regular quarterly dividend of 2½ per cent and the regular extra dividend of 2½ per cent, payable July 10 to stockholders of record July 1. Directors of the Bell Telephone Company, of Missouri, have declared a regular quarterly dividend of 2 per cent, payable July 1. Directors of the Otis Elevator Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable July 15. Directors of the International Nickel Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable August 1.

MANILA ELECTRIC REPORT.—The Manila Electric Railroad & Lighting Corporation has issued its annual report for the year ended Dec. 31, 1906. The consolidated income account compares with the previous year as follows:

Gross earnings:	1906.	1905.	Changes.	
Light and power	$381,120	$328,417	Inc.	$52,703
Railway	513,840	347,316	Inc.	166,524
Trucking	15,514	47,793	Dec.	32,279
Total	$910,474	$723,526	Inc.	$186,948
Operating expenses:				
Light and power	$184,321	$168,458	Inc.	$15,863
Railway	269,361	165,234	Inc.	104,127
Trucking	14,167	36,286	Dec.	22,119
Total	$467,849	$369,978	Inc.	$97,871
Net earnings	442,625	353,548	Inc.	89,077
Other income	.....	1,122	Dec.	1,122
Total net	$442,625	$354,670	Inc.	$87,955
Interest on bonds	233,208	195,109	Inc.	38,099
Surplus for year	$209,417	$159,561	Inc.	$49,856

The operation of the railroad department was inaugurated on April 10, 1905, so that the figures for 1905 cover operations of the railroad department for less than nine months. This system, which was organized by J. G. White & Company, has capital stock of $6,000,000 and bonds of $4,785,000. It is on a good dividend basis.

CHICAGO SUBWAY.—Mr. J. Ogden Armour and a few Eastern interests are now in full control of the operation of the Illinois Tunnel Company. Samuel McRoberts, treasurer of Armour & Company, has been made president of the tunnel company. He succeeded Albert G. Wheeler. Mr. McRoberts was put on the directory to succeed P. A. Valentine. Mr. Armour became a member of the board. No changes have been made in the executive committee, of which A. J. Farling, president of the Chicago, Milwaukee & St. Paul Road, is chairman. Mr. Farling is an Armour man, so that the affairs of the Tunnel Company are completely dominated by Armour interests. E. H. Harriman is interested with Mr. Armour. They have agreed to raise substantially $4,000,000 to provide for future needs of the company. While no new construction work is planned at this time, much will be expended in completing connections with various sources of freight. Mr. W. J. C. Kenyon, president and general manager of the Union Stock Yards, at Omaha, has been elected general manager of the company. He is an Armour representative.

EARNINGS AT COLUMBUS, GA.—The Columbus (Ga.) Electric Company reports $324,111 gross earnings for the year, including April, and a surplus of $24,694 over all charges and improvements. The Columbus Electric Company owns all the securities of the Gas Light Company of Columbus, all the second mortgage bonds of the Columbus Railroad Company, $344,000 first mortgage bonds of an issue of $450,000 of the Columbus Railroad Company, and 12,487 shares of a total of 12,500 shares of the capital stock of the Columbus Railroad Company. The above companies do the entire electric railway, electric lighting and gas business in the city of Columbus and the adjoining towns of Phœnix and Girard. The Columbus Electric Company also owns 1213 shares of a total of 3500 shares of the preferred stock of the Columbus Power Company, and 15,000 shares, being the entire issue, of the common stock of the Columbus Power Company. The Columbus Electric Company also guarantees the payment of $1,650,000 of 5 per cent bonds and $250,000 of notes of the Columbus Power Company.

UNITED SECURITIES BONDS.—Parkinson & Burr, of Boston and New York, have purchased a new issue of United Electric Securities Company bonds of which they offer $100,000, twenty-fifth series collateral trust gold 5s, due February, 1937, at 99 and interest. The call feature of these bonds, which is almost invariably exercised, makes the income return substantially over 5 per cent and, as new issues are frequently put on the market at a figure below the calling price, holders of these securities can usually replace their bonds at a slight profit.

ELECTRIC PROPERTIES REPORT.—The Electric Properties Company has issued its first annual report for the fiscal year (11 months) ended April 30, 1907, as follows:

Earnings	$388,248
Organ, legal and general expenses	104,741
Net	$283,504
Preferred dividend	128,057
Common dividend	120,000
Surplus	$35,447

The balance sheet shows assests and liabilities as follows:

ASSETS.

Cash, including balance due on subscriptions subject to call	$2,083,851
Sub-cos. (Westinghouse, Church, Kerr & Co.)	7,000,000
Investment securities	817,595
Total	$9,901,446

LIABILITIES.

Common stock	$6,000,000
Preferred stock	3,866,000
Surplus	35,446
Total	$9,901,446

At the first annual meeting of the Electric Properties Company the following directors whose terms of office expired were re-elected: H. Starr Giddings, George C. Smith, New York; E. G. Tillotson, Cleveland; John F. Wallace, New York; Theodore Vorhees, Philadelphia; F. Q. Brown, New York. The other members of the board are Paul D. Cravath, New York; John A. Spoor, Chicago; Moses Taylor, New York; F. D. Underwood, New York; J. R. McGinley, Pittsburg; E. H. Jennings, Pittsburg; Charles H. Allen, N. W. Halsey, Robert B. Van Cortlandt, New York; George Westinghouse, Pittsburg; C. Sidney Shepard, New Haven, and W. H. Bixby, St. Louis, Mo. Immediately after the adjournment of the stockholders' meeting the board of directors organized and elected the following officers: John F. Wallace, president; George C. Smith, vice-president; P. F. Thompson, vice-president; John Seager, secretary; R. B. Keating, assistant secretary, and W. A. Esselstyn, treasurer.

MICHIGAN TELEPHONE REPORT.—The annual report of the Michigan State Telephone Company, which operates as the licensee in Michigan of the Bell or American Telephone & Telegraph Company, shows gross earnings for the year ended Dec. 31, 1906, of $2,661,296, compared with $2,293,552 for 1905. In the same period exchange stations increased 15,529 in number to a total of 92,576. Net earnings for the year, however, show a falling off. In the year just closed they were $632,263, compared with $673,328 in 1905. The net surplus for the year was $140,337, against $259,459 in 1905; leaving the total surplus at $463,090. Net surplus after the deduction of amounts chargeable against surplus, amounting to only $2,422, against $69,363 in the previous year, was $460,667. The reduction of net earnings is thus explained in the annual report: "The heavy work of rehabilitation and extension made necessary the expenditure of large amounts chargeable to reconstruction, (operating expense), thus unduly reducing the amount of net earnings, which were also unfavorably affected by a material increase of wages paid to the employees. During 1907 the company will pursue a conservative policy regarding construction expenditures, the amount properly chargeable to reconstruction will be reduced, and a material increase in net earnings is expected. A bill for a receiver for the Michigan State Telephone Company and charging the directors and all concerned in the foreclosure proceedings of the predecessor company, the Michigan Telephone Company, with gross fraud has been filed in the Wayne County Circuit Court at Detroit. Attorneys who filed the bill are said to represent stockholders in the late Michigan Telephone Company who lost about $250,000 when the reorganization into the Michigan State Telephone Company took place.

NEW YORK STATE CONSOLIDATION.—The Utica Gas & Electric Company, a Brady concern, has made application to the state gas and electric commission for permission to issue $2,000,000 5 per cent 50-year bonds under a mortgage and to acquire the capital stock of the Herkimer County Light & Power Company, the Glens Falls Gas & Electric Light Company, the Consolidated Light & Power Company of Whitehall and 51 per cent of the United Gas, Electric Light & Fuel Company. The Utica Gas Company has a capital of $2,000,000, and a bonded indebtedness of $3,321,000. The Herkimer County Light & Power Company furnishes gas and electricity in the city of Little Falls and the towns and villages of Herkimer, Ilion, Mohawk and Dolgeville. The authorized capital stock of the company is $400,000, of which there is issued and outstanding $355,000. The United Gas, Electric Light & Fuel Company is engaged in the electric business in the towns and villages of Sandy Hill, Fort Edward and South Glens Falls, Its capital stock amounts to $200,000, all issued, and its bonded indebtedness to $150,000. The Glens Falls Gas & Electric Light Company, located at Glens Falls, has an authorized capital stock of $250,000, of which there is issued $190,000, and a bonded indebtedness of $250,000. This company has a gas plant and a small electric light plant at Glens Falls, but obtains the bulk of its electricity through a contract with the Union Bag & Paper Company. The Consolidated Light & Power Company is engaged in furnishing electricity at Whitehall, Washington County. Its capital stock is $75,000, all issued, and its bonded indebtedness $36,000.

THE BALTIMORE MERGER.—A mortgage deed of trust for $7,500,000 from the Baltimore Electric Company to the Northern Trust Company of Philadelphia has been filed in the Superior Court, Baltimore, Md. This mortgage conveys all the land and property, including plants and all equipment, all easements and franchises and all the income and profits of the local concern to the Philadelphia corporation, in trust. The deed also includes the bonds of the Maryland Telephone & Telegraph Company, which are quoted at a par value of $849,000. This transaction completes the plan of consolidation and capitalization of the Baltimore Electric Company, which recently was formed by the merging of the Baltimore Electric Power Company and the Maryland Telephone & Telegraph Company.

B. R. T. MORTGAGES.—In accordance with plans formulated a short time ago by the Brooklyn Rapid Transit System the stockholders of Brooklyn Union Elevated have authorized the execution of a mortgage amounting to $20,000,000. It is planned to have the Nassau Electric Railway stockholders authorize a mortgage of $5,000,000. The purpose of these mortgages is to afford greater security to B. R. T. for the funds advanced by it for improvements on lines of these two subsidiary companies. Much of the full amount of the $25,000,000 covered by the mortgages has already been advanced by the B. R. T. and is taken care of by certificates of indebtedness given by the subsidiary companies.

NEW TELEGRAPH STOCK.—The $2,082,400 additional capital stock of the Central & South American Telegraph Company listed on the Stock Exchange last week is a portion of the $4,000,000 increase voted May 14 and makes the total amount listed $10,000,000. The additional capital was voted for the purpose of capitalizing the earnings expended for the duplicate cable to Valparaiso, Iquique and Chorrillos and for other capital expenditures for improvements and additions made out of earnings.

MILLIKEN BROTHERS' FAILURE.—Messrs. William L. Ward, Augustus Hecksher and J. Van Vechten Olcott have been appointed receivers of the Milliken Brothers. The bond required is for $500,000. Bankers interested in the bonds of Milliken Brothers say that they expect the receivers to pay the next interest installment, which falls due Aug. 1, and amounts to $90,000. They assert that they have no fears but that the business will be continued and the interests of the bondholders fully protected.

ALBANY TRACTION BONDS.—The directors of the United Traction Company have authorized the issue of $850,000 4½ per cent first consolidated mortgage bonds under the mortgage for $6,500,000 made by the company in 1904. When this amount is issued all the bonds under the mortgage will have been put out. The money raised is for extensions in Albany and Troy.

AMERICAN RAILWAY EARNINGS.—The subsidiary companies of the American Railways Company report for the month of May and eleven months ended May 31 as follows.

	1907.	1906.		
May gross	$249,155	$225,686	Inc.	$23,469
Eleven months gross	2,593,903	2,363,219	Inc.	230,684

WESTERN UNION EARNINGS.—The Western Union statement shows earnings for the quarter of $1,650,000 net and a surplus, after fixed charges and dividends, of $66,791, which added to the previous surplus makes a total surplus of $17,019,898. The company appears to be barely earning its present rate of dividend.

GENERAL NEWS

Construction News.

ENTERPRISE, ALA.—The citizens are contemplating increasing the capacity of the municipal electric light plant and may install a dynamo and engine of about 300 hp. H. H. Bailey is superintendent.

MOBILE, ALA.—H. M. Byllesby & Company, of Chicago., Ill., have been retained as consulting and supervising engineers by the Mobile & Ohio Railroad Company, for the rehabilitation and electrification of its general repair shops at Whistler, Ala.

MONTGOMERY, ALA.—The building committee of the Alabama University has authorized Architect Lockwood to prepare plans for a power station, an engineering building and a geological museum, the cost not to exceed $100,000.

TALLADEGA, ALA.—The Talladega Electric Power Company is preparing to discard the flat rate system and is installing meters. The company also propose to give lamp renewals free, and ten per cent reduction is allowed on bills paid within the first ten days of the month.

COLUSA, CAL.—The Board of Supervisors has granted a franchise to the Snow Mountain Power Company to erect transmission lines along the county roads to transmit electricity from its plant to be built at Stony Ford to all parts of Sacramento Valley.

DOWNIEVILLE, CAL.—The electric power plant of the Four Hills Company situated in the extreme northern part of Sierra County, was recently destroyed by high water, parts of the building being carried down the canyon for half a mile. The plant consisted of two 2300-volt generators driven by water wheels under 960 feet head.

LOS ANGELES, CAL.—The City Council on June 5 granted the Los Angeles Pacific Railway Company a franchise for a railway tunnel under North Hill Street between First and Temple Streets.

MANTON, CAL.—The large reservoir which the Northern California Power Company has been building at Macomber Flat, has been completed and the water turned into it. The large force of men which has been engaged upon it is being transferred to the power site on Battle Creek, where the company is rushing the work in order to make good its title to 80,000 miner's inches of water claimed by the Pacific Power Company. The Northern California Power Company will connect at Chico with the transmission system of the California Gas & Electric Corporation which transmits electricity to Sacramento, Oakland and San Francisco.

NAPA, CAL.—W. J. Linddow has been granted a franchise to erect and maintain an electric light system in this city.

OAKLAND, CAL.—The Oakland Gas Light & Heat Company has recently made a reduction of 10 per cent in its rates for electricity, the price ranging from four to nine cents. The company has also reduced the price of gas for lighting purposes from $1.15 to $1 per thousand cubic feet.

OROVILLE, CAL.—The construction headquarters of the Great Western Power Company are again stationed at Oroville. W. H. Bissell, purchasing agent, is in charge.

ST. HELENA, CAL.—Sealed bids will be received by the Board of Trustees until July 9, for the sale of a franchise that has been applied for by Henry Brown, for a period of 50 years, for transmitting electricity for light and power. G. W. Schmidt is president of the board.

SAN FRANCISCO, CAL.—The Home Telephone Company has filed a mortgage to guarantee an issue of $10,000,000 in bonds. The company has commenced active operations to install its system throughout the city. Work has begun on the construction of the conduits and the building on Grant Avenue and Harlan Place.

SAN FRANCISCO, CAL.—The Metropolitan Light & Power Company, successor to the San Francisco Coke & Gas Company, has given a mortgage to the Knickerbocker Trust Company on all its properties to secure a bond issue to the amount of $7,500,000. A former bond issue of $2,500,000 is to be retired, and with the $5,000,000 remaining the company purposes an extensive development of its plant.

UKIAH, CAL.—Sealed bids will be received by the Board of Trustees, July 13, for the purchase of a franchise of the Snow Mountain Water & Power Company to erect and maintain a transmission line in the town of Potter Valley. W. V. Kilbourne is clerk.

WILLOWS, CAL.—A. S. Lindstom, of Willows, writes that the Snow Mountain Electric Power Company will install two 1500-kw units connected to water wheels under 800-ft. head, 100 miles of transmission line, part steel towers, having a potential of 45,000 or 60,000 volts.

DENVER, COL.—The Idaho-Nevada Power Company, recently incorporated, and which will operate principally in Idaho and Nevada, is to be an auxiliary to the Central Colorado Power Company, recently incorporated in Colorado with a capitalization of $22,000,000. In this concern are Myron T. Herrick, former Governor of Ohio; Thomas F. Walsh and David H. Moffat, of Colorado, and a number of other prominent capitalists of Colorado and the East. The aim of these concerns is to place electrical energy within easy reach of struggling townsites, mining industries, electric car lines, etc.

BRISTOL, CONN.—F. A. Schaffer is installing an electric motor for power purposes in his new building.

NORWICH, CONN.—The Consolidated Railway Company has awarded the contract for laying a submarine power cable under the Thames River at this place, to the T. A. Scott Company, of New London. The cable will effect a connection between the company's power plant at Thamesville and the electric railway system at Central Village.

WILMINGTON, DEL.—The directors of the Street and Sewer Department have passed over the veto of Mayor Wilson the franchise of the Commercial Light, Heat & Power Company.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 25 for furnishing naval supplies at the various navy yards and naval stations as follows: New York, N. Y., and Guanatanamo, Cuba, schedule 932, incandescent lamps, electric cables and supplies. Schedule 943, copper flexible tubing, etc. Schedule 946, sheet copper, etc. Schedule 921, motor, etc. Annapolis, Md., schedule 951, electrical wire and supplies, etc. Washington, D. C., schedule 939, sheet and ingot copper, aluminum, nickel, etc. Schedule 941, motor, electrical supplies, etc. Norfolk, Va., schedule 920, electric pump, etc. Applications should designate the schedules desired by number. E. B. Rogers, paymaster general, U. S. N.

COLUMBUS, GA.—The City Council on June 6 adopted a resolution in which it stands committed to call an election to vote on the proposition of issuing bonds for a municipal electric lighting plant in case the following rates for electricity for lighting cannot be secured. The maximum rate to be charged for arc lamps of 2000 cp is $60 per lamp per year, and 10 cents per kw-hour meter rate.

BOISE, IDAHO.—Negotiations are under way by the Idaho-Oregon Light & Power Company for the purchase of the stock of the Boise-Payette River Electric Power Company. The first-named company was recently organized for the purpose of installing a large power plant at the big bend of the Snake River, below Huntington. The company has also recently purchased a controlling interest in the Electric Power Company, Ltd., of this city. The principal owners of the Idaho-Oregon company are William and Sinclair Mainland, of Oshkosh, Wis.

BLOOMINGTON, ILL.—Engineer A. T. Wathery has completed his report on the cost of remodeling the municipal electric light plant, the cost of which he estimates at $40,000.

BUNKER HILL, ILL.—We are informed that plans are being made to increase the capacity of the municipal electric light plant, and that the city is in the market for a new boiler of from 100 to 150 hp, and also expects to install an engine direct-connected to a 110-volt dynamo rated at 30 kw. Address all communications to W. H. Coffee, superintendent.

CHICAGO, ILL.—The contract for furnishing electric motors and controller equipment for the South Halstead Bridge, has been awarded to the General Electric Company, of Schenectady, N. Y., for $2,350.

CHICAGO, ILL.—The City Council on June 6 authorized the Mayor and Controller to make a contract with the Drainage Board for electrical power to the amount of 7000 hp-hours per day. The city is to pay $1.25 per horse-power per month on the eleven-hour schedule, and $2.20 on the twenty-four-hour schedule. The city obligates itself to use the power for municipal purposes only.

CHICAGO, ILL.—Bids will be received by William Carroll, city electrician, room 12 City Hall, Chicago, Ill., until June 29 for furnishing, erecting, and installing four 500-kw, single-phase, 60-cycle oil insulated step-down transformers at the municipal electric light power station at Fullerton Avenue; also for furnishing, erecting and installing switchboards and accessories, including all the various meters, meter starting panels, oil switches, other switches, lightning arresters, with other necessary equipment in accordance with specifications: One switchboard to be set up at the municipal electric light station located at 299 South Halsted Street, to provide for two 1200-hp motors and equipment; also one to be set up in the station located at Rice and Lincoln Streets to provide for one 1200-hp motor and equipment, and also one to be set up in the Wentworth Avenue station to provide for one 1200-hp motor and equipment. Bids will also be received until June 25 for furnishing and installing the following: A six duct conduit system on Wentworth Avenue consisting of about 18,690 trench feet and 47 manhole vaults; an eight duct conduit system on Western Avenue to consist of about 5200 trench feet and 13 manhole vaults; also about 30,700 feet of three-conductor lead-incased cable, to be placed in the city conduits and tunnels.

DE KALB, ILL.—The De Kalb-Sycamore Electric Company is contemplating making extensions and improvements to its plant, which include the installation of boilers of 800 hp and a 120-ft. stack. The company will also install apparatus for handling coal and ashes.

FREEPORT, ILL.—C. W. Morse, president of several Massachusetts gas companies, has purchased the property of the Freeport Gas & Electric Company. The price is said to be over $250,000.

LEBANON, ILL.—The Carlyle & St. Louis Electric Railway is making arrangements to extend its line from Carlyle to Lebanon, a distance of 23 miles, and will soon let contracts for the construction of the road.

PEKIN, ILL.—The directors of the Citizens' Telephone Company have been authorized to purchase the property of the Pekin Telephone Company. The merger of the two companies will take effect about the first of July. The new directors have been elected as follows: J. W. Barrett, V. P. Turner, W. B. Cooney, E. R. Peyton, J. A. Roelfs, John Fitzgerald and H. G. Herget. The directors elected J. W. Barrett as president and John Fitzgerald, secretary.

ROODHOUSE, ILL.—The Central Light, Heat & Power Company is making arrangements to increase the capacity of its plant and will soon install a 150-kw, Eddy dynamo and an engine of 250 hp, and is also making about three miles of line extension. Charles S. Ford is superintendent.

STERLING ILL.—The Tampico Farmers' Telephone Company has increased its capital stock from $6,000 to $10,000.

BEDFORD, IND.—It is stated that plans are being prepared by Bert Baldwin & Company, of Cincinnati, Ohio, for an addition to the power plant of the United States Portland Cement Company in this city, which will include an 800-kw turbine and one of 75-kw capacity.

BLOOMINGTON, IND.—It is reported that the National Light, Heat & Power Company will soon invite bids for the construction of a new plant on the site of the People's plant recently destroyed by fire.

COLUMBIA CITY, IND.—Surveys are now being made by the Winona Interurban Railway Company for its proposed road from Columbia City to Arcola.

FORT BENJAMIN HARRISON, IND.—Bids will be received by Captain George H. Penrose, quartermaster, U. S. A., until June 27 (re-advertisement) for electric energy, electric lighting system, including building for transformer sub-station; also for lamp fixtures.

MICHIGAN CITY, IND.—The Michigan City Gas & Electric Company is contemplating the erection of a new power house at the south side of the harbor east of the old water works.

NEWCASTLE, IND.—The Central Union Telephone Company is rebuilding its lines and extending its system throughout the city. The new improvements will involve an expenditure of about $10,000.

WASHINGTON, IND.—Experts have reported to the city authorities that it will cost $65,000 to remodel, equip and put the electric light plant in good condition. They also report that the boilers are unsafe and will have to be replaced with new ones.

RED FORK, I. T.—The City Council has granted a franchise to J. E. Dunn, of St. Louis, Mo., and Graham Burnham, of Kansas City, Mo., for water works, gas plant and street railway system.

DES MOINES, IA.—The Midland Electric Company has been awarded the contract for the electric work for the east side exchange of the Mutual Telephone Company.

DUBUQUE, IOWA.—The Union Electric Company has filed an amendment to its articles of incorporation increasing its capital stock from $1,000,000 to $1,500,000, the proceeds of which will be used for general improvements to its system.

KEOKUK, IA.—The Keokuk Electric Railway & Power Company is contemplating installing new machinery in its plant and improvements to its system, which will involve an expenditure of about $10,000.

DOWNS, KAN.—Application has been made to the City Council by Mr. Stephenson for a franchise to construct an electric light plant, to cost about $12,000.

HERINGTON, KAN.—E. E. Rogers, of Hutchinson, has secured the contract for installing an electric light plant in this place.

BROOKSVILLE, KY.—The Bracken County Telephone Company has filed an amendment to its articles of incorporation increasing its capital stock from $10,000 to $20,000.

LOUISVILLE, KY.—The Evansville & Eastern Traction Company, which recently opened its line to Rockport, is contemplating another extension of its line from Rockport to the towns of Troy, Tell City and Cannelton.

FRANKLIN, LA.—The contract for the construction of the new municipal electric light plant has been awarded to Muralt & Company, of New York, N. Y. The plant will have a capacity of 150-kw and will furnish electricity for about 3000 incandescent lamps. The street lighting system will consist of 25 arc lamps and 40 incandescent lamps.

LAWRENCE, MASS.—The new power plant of the Pacific Mills will have a capacity of 3000 hp and provision is being made for the development of 10,000 hp. The initial equipment will consist of three 750-kw turbo-generator sets of Parsons type, twelve boilers, 72 inches in diameter, with 20-foot tubes set in batteries of four each.

NORTHBORO, MASS.—A committee has been appointed to investigate the question of street lighting and to make arrangements with the Marlboro Electric Company for lighting the town for a term of ten years. If 50 subscribers can be secured for resident and commercial lighting the company will make a reduction in rates. The members of the committee are H. M. Peinze, George H. Felt and C. E. Buckley.

HOLLAND, MICH.—William Van Eyck, city clerk, writes that the citizens on June 10 voted to issue $30,000 in bonds to increase the capacity of the electric light plant.

ISHPEMING, MICH.—The Marquette County Gas & Electric Company is contemplating increasing the capacity of its plant by the installation of new turbines and boilers. W. J. McCorkindale is manager.

MARQUETTE, MICH.—The Governor has signed the bill authorizing this city to issue bonds to extend the electric lighting system.

NEGAUNEE, MICH.—At the special election held recently the citizens voted against the proposition to sell the municipal electric lighting plant and also against the bond issue of $15,000 for the purpose of improving the plant, which are held to be imperatively necessary. The proposition of selling the plant was defeated by a vote of more than two to one. In consequence of the close vote for issuing bonds, another special election will soon be held at which the bonding proposition will be submitted again.

PAW PAW, MICH.—Bids will be received until June 25 by the village president and trustees for furnishing material and constructing a hydro-electric power plant and dam on Paw Paw River, and certain water works and electric light improvements in the village of Paw Paw, the cost of which is estimated at $35,000. William H. Mason is village clerk.

SAGINAW, MICH.—The Valley Telephone Company has decided to rebuild and extend its system in this city. A new exchange will be built and the wires will be placed underground in the business district, work on which will begin soon. The cost of the work is estimated from $150,000 to $200,000.

AURORA, MINN.—The Aurora Electric Light Company has petitioned for a franchise to erect an electric lighting system in this place.

BIWABIK, MINN.—It is reported that the Biwabik Mining Company has decided to construct an electric light plant and water works system in this place.

MARSHALL, MINN.—The citizens on June 11 voted to issue $17,000 in bonds to enlarge and repair the municipal electric light plant.

ST. PETER, MINN.—The stockholders of the Nicollet County Telephone Company have voted to increase the capital stock of the company from $100,000 to $125,000.

MERIDIAN, MISS.—The Meridian Light & Railway Company will extend the Twenty-fourth Avenue car line to Popular Springs, a distance of three miles. The company also announces that it will expend $263,500 immediately in improvements.

EDINA, MO.—The plant and holdings of the Edina Electric Light & Power Company have been purchased by G. W. Newman and associates. The new owners will make improvements and put the plant in first-class condition. G. W. Newman will be general manager.

ST. JOSEPH, MO.—The Citizens' Telephone Company is contemplating the construction of a new telephone exchange building, plans for which have been approved.

ST. LOUIS, MO.—Clark Brothers, of Philadelphia, Pa., who own the Laclede Power Company, have made known to Supervisor Carter, of the city lighting department, that they will enter into competition with the North American Company for the contract for lighting public buildings, and will also have a bid on the contract for lighting city streets and parks, to let as soon as the ordinance now pending in the Board of Public Improvements is passed. The North American Company owns the Union Electric Light & Power Company, of St. Louis, now furnishing electricity for lighting the streets.

UNIVERSITY PLACE, NEB.—At a special election held June 8, the citizens voted to issue $15,000 in bonds to rebuild the electric lighting system.

RENO, NEV.—Instructions have been received by George A. Campbell, manager of the Reno Power, Light & Water Company, and F. O. Broili, superintendent of the Truckee River General Electric Company, to institute immediate improvements in the two systems now supplying electricity for light and power in this city. The sub-stations of the Truckee River General Electric Company and the Reno Power, Light & Water Company will be moved out of the city limits, and established at the old power station on the south bank of the Truckee River, near the western limit of the city. The work will cost about $30,000.

SEARCHLIGHT, NEV.—A number of mining men in this place are promoting a scheme for the installation of a large electrical power plant on the Colorado River to furnish electricity for power and light to all the mines in the southern portion of Nevada, and particularly in Searchlight.

JERSEY CITY, N. J.—The Street and Water Board on June 10 adopted a resolution, calling for the preparation of specifications for lighting the city by electricity, either on a five year or a one year contract.

ORANGE, N. J.—Justice Pitney on June 10 announced that the supreme Court had set aside the resolutions awarding certain contracts to the Crocker-Wheeler Company and the Western Electric Company for the construction of a municipal lighting plant. The amount of the contracts aggregated about $70,000. The city of Orange has no power under the statute invoked, according to the courts, to maintain a municipal light plant.

AMITYVILLE, N. Y.—A franchise has been granted by the Village Board to the Huntington & Babylon Railroad Company to construct and maintain an electric railway on certain streets in the village. The franchise is for a term of 50 years.

BUFFALO, N. Y.—The Buffalo & Lake Erie Traction Company has placed a contract with the General Electric Company for a new power plant at Athol Springs, to be completed by August 15.

CANANDAIGUA, N. Y.—The State Railroad Commission has granted the Canandaigua Southern Electric Railroad Company permission to issue a mortgage for $2,000,000.

COHOES, N. Y.—The Beattie Machine Works has contracted with the Hudson River Electric Power Company to furnish electricity to operate its machine works.

ELMIRA, N. Y.—The Elmira, Corning & Waverly Railroad Company has been granted a franchise by the Town Board of Southport to operate its proposed road through the town.

LONG ISLAND CITY, N. Y.—Bids will be received until June 24 by C. B. J. Snyder, superintendent school buildings, New York City, for installing electric equipment in School 38, Fresh Pond, borough of Queens.

NEW YORK, N. Y.—C. B. J. Snyder, superintendent school buildings, New York City, has awarded the contract for installing electric equipment in addition to School 41, borough of Manhattan, to L. F. Benn, 725 Broadway, New York City, for $4,540.

NIAGARA FALLS, N. Y.—The Ontario Power Company is to furnish electric power for operating the electric roads of the Buffalo & Lake Erie Traction Company between Buffalo and Erie, including those at Dunkirk. The company will also furnish electricity for manufacturing purposes in Dunkirk and other places along the railway lines.

OLEAN, N. Y.—The State Railroad Commission has given the Western New York & Pennsylvania Traction Company permission to issue $300,000 additional bonds under a first refunding mortgage for $5,000,000.

SALEM, N. Y.—At the last meeting of the New York State Gas and Electric Commission, the application of the Salem Light, Heat & Power Company for a certificate of authority to transact business in Salem, was granted. Consent was asked to the issue of $35,000 capital stock and bonds to the amount of $35,000. The commission reduced these amounts to $25,000 of each.

SODUS, N. Y.—The Sodus Gas & Electric Light Company has applied to the State Commission of Gas and Electricity for authority to increase its capital stock from $15,000 to $90,000, the proceeds to be used for extensions to its system. The company is contemplating extending its system to Williamson, Ontario and Webster.

ARLINGTON, OHIO.—The city clerk writes that bids will be received until July 9 for the construction of an electric light plant, to cost about $8,000. George Champe, of Toledo, is engineer.

CINCINNATI, OHIO.—Archibald S. White, president of the Columbia Gas & Electric Company has leased the gas, electric properties and electric railway lines of the neighboring towns of Covington, Newport, Bellevue and Dayton, Ky.

JACKSON CENTER, OHIO.—The Jackson Center Telephone Company has increased its capital stock from $25,000 to $40,000.

SIDNEY, OHIO.—T. E. Newby, city clerk, writes that the citizens on June 10 voted to grant a franchise to E. C. Hillman, of Quincy, Ill., for an electric lighting system for a term of 25 years. Electricity will be transmitted from Hamburg, 12 miles distant.

SPRINGFIELD, OHIO.—Stockholders of the People's Light, Heat & Power Company have decided to issue $250,000 in bonds, part of which will be used for improvements and extensions. A direct current system will be installed to take the place of the alternating system that has been in use.

YOUNGSTOWN, OHIO.—The plant of the Banner Electric Company, located on Market Street, will be extended through to Williams Street, making the building over 430 feet long. This will make it possible to double the output of the plant, whose capacity has proved too small to supply the demand. General Manager Norman L. Norris stated that the land for the addition had been purchased and that work on the building would be commenced as soon as possible.

EL RENO, OKLA.—Extensive improvements and additions are being made to the plant and system of the El Reno Gas & Electric Company, which consists of the installation of an additional 250-kw Bullock alternator direct-connected to a Murray Corliss engine and a 200-hp tubular boiler. The company is also adding four miles of pole line and 12 miles of wire line to its distributing system. The street lighting contract has been increased from 68 to 90 series arc lamps.

SHATTUCK, OKLA.—The City Council has granted a 25-year franchise to the Shattuck Electric Light & Power Company for an electric light and street railway system and cold storage plant.

WALTERS, OKLA.—Judge Holmes and R. Stephens are in town making investigations with a view of establishing an electric light plant here.

KLAMATH FALLS, ORE.—Plans are being made by C. S. and R. S. Moore for the construction of their plant on the west side, which they now expect to have in operation by Dec. 1. Wyatt H. Allen, of the firm of Hunt, Dillman, Meredith & Allen, of San Francisco, Cal., is preparing the plans for the plant, which will have a capacity of 800 hp, and will furnish electricity for lighting and power throughout the entire basin. Water for operating the plant will be taken from the Government irrigating project near Keno, where rights for 15,000 miner's inches have been reserved.

MEDFORD, ORE.—The Condor Power Company is changing the present incandescent street lighting system to arc lamps.

PANAMA.—Bids will be received by D. W. Ross, general purchasing officer, Isthmian Canal, Washington, D. C., until June 27, for furnishing dynamos, engines and switchboards, etc., as per circular No. 371.

ALLENTOWN, PA.—The Harwood Electric Power Company, chartered by the Pardee interests, has filed notice of a proposed bond issue of $2,000,000, the proceeds of which will be used for the extension of its business.

BRADFORD, PA.—Bids are wanted until July 15 for 141 (minimum) all night street lamps; contract to commence June 13, 1908. Edward C. Charlton is city clerk.

HARRISBURG, PA.—Application will be made to the Governor, June 27, for a charter for the Long Hollow Street Railway Company by H. E. Steel, F. Blair Isenburg, J. M. Starr, R. W. Jacobs and J. S. Woods. The company proposes to build a railway from Huntingdon to Lewistown, a distance of 12 miles.

HUNTINGTON, PA.—The Valley Electric Company is making surveys for a railway from this place through Big Valley to Reedsville, and is also contemplating extending its line across the Juniata River to the Pennsylvania Industrial Reformatory. Electricity for operating the road is furnished from the plant of the Wilson Electric Company at Alexandria.

JOHNSTOWN, PA.—The directors of the Northern Cambria Street Railway Company are considering extending the railway line from Barnesboro to Garman's Mills, a distance of three miles.

LANCASTER, PA.—Plans are being made by the directors of the Conestoga Traction Company, the Edison Electric Illuminating Company, the Columbia Electric Light Company and the Susquehanna Railway & Light Company for improvements and extensions to their systems, which includes reconstruction of some of the railway lines and the enlargement of the Engleside power plant and the erection of a new car barn.

LEWISBERRY, PA.—The Lewisberry & Strinestown Electric Railway Company has decided to extend its proposed line from a point on the New Cumberland extension near the village of New Market to New Cumberland and thence to Harrisburg. David Pepper, Jr., is president and J. D. Wuncan, secretary of the company.

NORRISTOWN, PA.—The Montgomery Traction Company, operating the Lansdale-Norristown electric line, announces that it will avail itself of the eminent domain bill by constructing an electric road from Norristown to Ambler, and may continue it to Willow Grove.

SOUDERTON, PA.—The Borough Council has recently contracted with a private company to furnish electricity for operating the municipal electric lighting system. Electricity will be supplied for four cents per kw-hour, and will be retailed by the borough at the rate of eight cents per kw-hour. The borough will maintain the lamps and wires.

SOUTH BETHLEHEM, PA.—The South Bethlehem & Saucon Street Railway Company is planning to begin the construction of its line from South Bethlehem to Centre Valley at once.

SUNBURY, PA.—The Middle Creek Electric Light Company is contemplating the construction of a dam at Trexlerville on Penn's Creek. The company will supply the new electric railway, which is to run from Selinsgrove to Sunbury, with electricity to operate the road. The company is now furnishing electricity for lighting residences at Shamokin Dam and is making arrangements to run its line to Clement's Park opposite Sunbury.

TOWANDA, PA.—Thinking that the borough was paying too much for electric light the Council recently ordered the Towanda Electric Illuminating Company to discontinue the street lighting service at existing prices, and the town has been in darkness since. The price paid for arc lamps was $60 per lamp per year. A committee has been appointed by the Council to ascertain the cost of erecting a municipal electric lighting plant.

WAYNESBORO, PA.—The Chambersburg & Southern Railway Company is contemplating the construction of an electric railway from Greencastle to Mercersburg. H. B. McNulty, of Chambersburg, is interested in the project.

SIOUX FALLS, S. D.—F. M. Mills, of Benton Harbor, Mich., who is promoting the Sioux Falls Traction system, states that he will soon organize and incorporate a company. Work on the construction of the road will begin as soon as the material which has already been ordered arrives, and track laying will begin early in July. Electricity for operating the road will be furnished by the Sioux Falls Light & Power Company. Mr. Mills also states that he is in the market for a number of cars and overhead equipment.

CHATTANOOGA, TENN.—Samuel Divine, promoter and builder of the Chattanooga-Dalton, Ga., interurban electric railway, has applied for franchises for a new company which he has organized, to build a railway from Boynton Park to the foot of Missionary Ridge, a distance of six miles. Mr. Divine has also applied for franchises in other portions of the city, which will mean the construction of about ten miles of new electric lines in Chattanooga and suburbs. Mr. Divine has also formed another company to build a road to Chickamauga Park. C. E. James is understood to be behind the last-named project.

LAWRENCEBURG, TENN.—Plans have been prepared by Kirkpatrick & Johnson, of Jackson, Miss., for the construction of an electric light plant and water works system in this place, to cost about $25,000.

GOLIAD, TEX.—Dr. L. W. Chilton is considering the question of installing an electric light plant in this town.

HOUSTON, TEX.—The capacity of the municipal electric light plant is to be almost doubled during the present summer, at a cost of about $75,000. A new 1500-kw turbo-generator set is to be installed.

HOUSTON, TEXAS.—The Houston Lighting & Power Company is contemplating extensive additions to its plant and will remove a 300-kw unit to install a 1500-kw turbo-generator set, and will also install a 500-hp Babcock & Wilcox boiler. William H. Chapman is the manager of the company.

BURLINGTON, VT.—The City Council has adopted a resolution fixing the rates for electricity as follows: Ten cents for the first 50 kw-hours per month; six cents from 50 to 100 kw-hours per month, and five and one-half cents for all over 100 kw-hours per month, provided the minimum charge shall be $1 per month, and also that the charge shall not exceed $12 per year unless the amount of electricity used shall exceed that amount.

BRISTOL, VA.—Theodore Swana, of Bristol, writes that a company has been organized with the following officers: J. D. Mitchell, president; W. L. Halstead and J. B. Baumgardner, vice-presidents, and Theodore Swann, secretary and treasurer. The company proposes to purchase from a developing company, financed by Charles Hall Davis and associates, of Petersburg, Va., and New York, N. Y., electric energy which will be generated at Fish Dam on the Holstom River, ten miles from Bristol. The company proposes to build a 60-ft. dam and develop 4000 horse-power. Charles Hansell & Company, of New York, N. Y., are the engineers in charge of the work.

BELLINGHAM, WASH.—The holdings and franchises of the Everett Electric Company have been purchased by the Stone & Webster syndicate, of Boston, Mass. This transfer insures the construction of an electric railway system from Tacoma to Vancouver.

ELKINS, W. VA.—The Elkins Electric Railway Company has decided to accept the franchise given by the City Council and will furnish the $5,000 bond required, and will soon commence work on the construction of the road. The company has been organized by electing J. C. McSpadden, of Rockwood, Pa., president; J. E. Morgan, of Elkins, vice-president, and W. J. Taylor, of Pittsburg, Pa., secretary and treasurer.

ROWLESBURG, W. VA.—The city of Rowlesburg is advertising for bids for constructing a complete electric light plant having a capacity of 50 arc and 2000 incandescent lamps. The plant is to be operated by steam. H. R. Hollis is city recorder.

BAYFIELD, WIS.—It is reported that an election will soon be held on the proposition of improving the electric light plant and the water works system.

DE PERE, WIS.—The De Pere Electric Light & Power Company has refused to accept a franchise from the city unless a clause, which puts the control of the company under the proposed State Board of Utilities, is inserted in the franchise.

SHULLSBURG, WIS.—F. Gundry, city clerk, writes that the citizens on June 11 voted against the proposition of issuing bonds for the construction of an electric light plant.

EDMONTON, ALTA.—The citizens on May 27 voted to issue $120,000 in bonds for an electric light and power plant.

VANCOUVER, B. C.—The Portland General Electric Company is contemplating installing a 400-kw, 60-cycle, two-phase, General Electric alternating-current generator to increase the capacity of its plant. This company is owned and controlled by the Portland Railway, Light & Power Company, of Portland, Ore. Chester C. Turley is local manager.

WINNIPEG, MAN.—Sealed tenders will be received by Magnus Peterson, secretary of the Civic Board of Control, until June 26 for the supply of 100 arc lamps and two regulators for the street electric lighting system. Plans and specifications may be seen at the office of F. E. Cambridge, city electrician.

WINNIPEG, MAN.—Bids will be received by the chairman, Board of Control, until September 3, for the construction of general works, and for supply and erection of various portions of equipment for the hydro-electric works and station at Point du Bois, for a transmission line between Point du Bois and Winnipeg, and for a receiving transformer station in Winnipeg. Individual bids will be received for telephone system; general works at Point du Bois; five 4000-hp turbines; two 450-hp turbines; five 3000-kw generators; two 250-kw generators; one induction motor; five step-up transformers; generating station, switching and accessory apparatus; generating station, light, heat and power systems; generating station oil and air systems; erection of transmission system of 75 miles; steel towers; high tension insulators; electric transmission cable; terminal station; five step-down transformers; terminal station, switching and accessory apparatus; terminal station, light, heat and power systems; terminal station, oil and air systems; testing transformers and apparatus; three electric traveling cranes; seven turbine governors; auxiliary apparatus; repair shops. Alternative lump-sum bid will be received for the entire work, including the above mentioned items together with additional work and equipment necessary to install a complete working plant; as a further alternative bidders may include or group together for individual items of such group. Plans and specifications may be obtained at the Power Engineer's office, Carnegie Library Building, Winnipeg.

FORT WILLIAM, ONT.—The ratepayers voted in favor of spending $26,000 on improvements to the municipal lighting system. Address Mayor Whalen.

REGINA, SASK.—The ratepayers have voted in favor of spending $60,000 for a municipal electric lighting plant. Address W. W. Smith, mayor.

PARRAL, MEX.—Work will soon commence on the new electric plant to be erected by the Capazuya Mining Company. Edward Ward will have charge of the work.

Company Elections.

CHICAGO, ILL.—At the annual meeting of the Chicago Edison Electric Company the old board of directors was re-elected as follows: Henry A. Blair, Edward L. Brewster, Samuel Insull, Robert T. Lincoln, Joseph Leiter, John J. Mitchell, Erskine M. Phelps, A. A. Sprague and Lambert Tree.

BOSTON, MASS.—At the annual meeting of the Metropolitan Home Telephone Company held June 10 the following officers were elected: Albert Clarke, president; Albert L. Ireland, vice-president; James G. Ferguson, treasurer, and Roger E. Miley, clerk.

RAVENA, N. Y.—At the annual meeting of the Ravena & Medway Telephone Company held recently the following officers were elected: William C. Harden, president; Arthur Hartt, vice-president; Ernest L. Haight, secretary; Harrie Mck. Curtis, treasurer, and Clifton Bedell, constructing manager.

New Industrial Companies.

THE FOLGA MACHINE & ELECTRIC COMPANY, of New York, N. Y., has been incorporated with a capital stock of $20,000. The directors are Vincent Ferk, J. F. Ambrose, Wilmerding, Pa., and E. A. Monfort, New York, N. Y.

THE HALLOCK ELECTRIC GENERATOR COMPANY, of Portland, Me., has been incorporated with a capital stock of $1,000,000 for the purpose of manufacturing and dealing in patented articles and machinery. H. R. Woodward is president and treasurer of the company.

THE MOON VIBRATOR COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $10,000 by A. W. Anthony, O. W. Roberts and C. W. Moon. The company proposes to manufacture electrical appliances, machinery and tools.

THE NORWALK ELECTRIC COMPANY, of Norwalk, Conn., has been organized by Charles E. Johnson, William J. Burr and W. H. Burr, for the purpose of doing a general electrical business.

New Incorporations.

PHOENIX, ARIZ.—The Phoenix & Western Development Company has been incorporated with a capital stock of $1,000,000, by S. S. Scull, S. S. Green, Lloyd B. Christy, Lysander Cassidy, of Phoenix, and George W. Mische, of Rochester, N. Y. The company has applied for a franchise through certain streets of Phoenix and over certain county roads for an electric railway from this city into Buckeye County.

MOOREFIELD, ARK.—The Moorefield Telephone Company has been organized by F. M. Ham and others.

SAN BERNARDINO, CAL.—The Westwater Power & Water Company has been incorporated with a capital stock of $600,000 by A. E. Poole, W. C. Hopkins, A. C. Lowe and Robert Westwater, all of Los Angeles.

GEORGETOWN, COL.—An electric power company has been organized with headquarters at Georgetown, Col., under the name of the Commonwealth Power & Electric Company, with a capital stock of $2,000,000, for the purpose of building reservoirs and dams to generate electric power. The company owns water rights and reservoir sites, which will develop, when completed, 7500 horse-power.

DALLAS, GA.—Articles of incorporation have been filed in Georgia for the Paulding County Electric Company, which proposes to build a 30-foot dam at the Owen's Mill site near Dallas, Ga. The authorized maximum capital is $250,000.

MANSFIELD, GA.—The Mansfield Water & Electric Light Company has been organized by E. H. Adams, W. E. Lunsford and A. B. Barber, to construct an electric light plant and water works system.

CULLOM, ILL.—Articles of incorporation have been filed for the Vermillion Mutual Telephone Company No. 2 with a capital stock of $1,500, by John Diebel, Charles Donnelly, William Frantz and Leonard Haag.

DISWOOD, ILL.—The Diswood Independent Telephone Company has been incorporated with a capital stock of $2,000 by D. L. Hesley, L. H. Vick and William McGrite.

PLYMOUTH, IND.—The Plymouth Electric Lighting Company has been incorporated to build, equip, maintain and operate an electric light plant at an estimated cost of $100,000. L. P. Kleitz, J. Emmerling and P. A. Neuffer are the directors.

SEYMOUR, IND.—The Citizens' Mutual Telephone Company has been incorporated with a capital stock of $10,000. The City Council has granted the company a franchise to construct and operate a telephone system in this city.

BAGLEY, IOWA.—The Bagley Mutual Telephone Company has been incorporated with a capital stock of $9,990.

LOW MOOR, IOWA.—The Low Moor Telephone Company has been incorporated with a capital stock of $5,000.

SYMSONIA, KY.—The Symsonia Telephone Company has been incorporated with a capital stock of $2,000 by J. H. Wallace, J. T. Draffen and others.

BUFFALO, N. Y.—Articles of incorporation have been filed with the Secretary of State for the H. I. Sackett Electric Company with a capital stock of $25,000. The directors are H. I. Sackett, John Hora, Jr., and W. F. Hoffheims, Buffalo, N. Y.

NIAGARA FALLS, N. Y.—A new company has been formed under the name of the Utility Construction & Operating Company, capitalized at $1,000,000, to furnish electricity in this city. The company has contracted with the Niagara, Lockport & Ontario Power Company for a large block of power and is now building a transmission line from Devil's Hole. The company has made temporary arrangements with the Home Telephone Company to use the poles on the main streets of the city. A temporary sub-station will be built immediately and work will soon commence on the construction of the company's plant at Main and Third Streets. James E. Rock is president.

LEWIS, N. D.—The Lewis Mutual Telephone Company has been incorporated with a capital stock of $50,000 by William E. Shortridge, Frank E. Tennant and A. E. Paulson, all of Lewis.

WILTON, N. D.—The Farmers' Mutual Telephone Company has been incorporated by C. B. Flinn and others.

LEBANON, OHIO.—The Dayton, Lebanon & Cincinnati Railroad & Terminal Company has been incorporated with a capital stock of $1,000,000. The new company will be a successor of the Dayton, Lebanon & Cincinnati Railroad, which was sold at a receiver's sale May 10.

YOUNGSTOWN, OHIO.—The Akron, Canton & Youngstown Railway Company has been chartered with a capital stock of $200,000 by G. W. Davis, Isaac H. Taylor, William Simpson, H. B. Stewart and M. L. Rackle.

PORTLAND, ORE.—The Portland Eastern Railway Company has been incorporated with a capital stock of $5,000,000 by E. P. Clark, Arthur H. Fleming, of Los Angeles, Cal.; E. B. Colwell, C. W. Miller and Robert T. Linney, of Portland. The Portland Eastern Railway is backed by the same parties, who recently incorporated the Mount Hood Power & Railway Company, and is part of the general plan. The Mount Hood Corporation will construct and equip the power plant and furnish electricity to Portland and for operating the railway, which will be in charge of the Portland Eastern Railway Company. Work has commenced on the construction of the power plant on the Upper Sandy River, and plans are being made to begin active operations on the construction of the railway.

HARRISBURG, PA.—A charter has been granted by the Secretary of State to the Palmyra & Campbellstown Electric Railway Company to build an electric line two-one half miles long from Campbellstown to Palmyra. The directors are Harry C. Baum, Harrisburg, president; F. R. Dissinger, L. Raymond Riegert, A. R. Horck and G. H. Mayer.

INDIAN CREEK, TEX.—The Indian Creek Telephone Company has been incorporated with a capital stock of $2,000 by T. J. McBride, S. Martin, D. T. Ford and others.

CAMERON, TEX.—The Rockdale Water, Power & Light Company, incorporated under the name of the Rockdale Improvement, has been sold under deed of trust to F. B. and L. K. King for $2,500.

LIVINGSTON, TEX.—The Livingston Electric Light Company has been incorporated with a capital stock of $2,000 by H. B. Davis and others.

ROCKDALE, TEX.—The Rockdale Water & Light Company has been incorporated with a capital stock of $50,000 by Leonard Isaacs, E. A. Wallace and others.

CRAM SCHOOLHOUSE, WASH.—The Pennewawa Telephone Company has been incorporated with a capital stock of $2,500 by Silas M. Smith, Willis F. Adams and others.

CHARLESTON, W. VA.—The South Charleston Water & Light Company has been incorporated with a capital stock of $100,000 by F. M. Staunton, E. T. Crawford and W. L. Ashby. The purpose of the company is to supply electricity and gas for lighting purposes and to operate street railways and to supply water.

APPLETON, WIS.—The Green Bay & Mississippi Canal Company has been chartered with a capital stock of $75,000 for the purpose of erecting a plant at this place in the near future.

MILWAUKEE, WIS.—The Wells Power Company has been incorporated with a capital stock of $100,000, and will take over the lighting, heating and power business of the Wells estate.

MILWAUKEE, WIS.—The Southern Wisconsin Railway Company has filed articles of incorporation with the Secretary of State with a capital stock of $100,000. The purpose of the company is to construct and operate street railways and to build and operate electric light and power plants. The incorporators are Charles F. Smith, William F. Adams and Albert R. Denu.

WEYERHAEUSER, WIS.—The Weyerhaeuser & Island Lake Telephone Company has been incorporated with a capital stock of $3,000 by E. J. Erickson, C. J. Muehle and W. C. Dole.

Legal.

RIGHT TO CONSTRUCT TELEPHONE LINE UNDER STATUTE AUTHORIZING ERECTION OF TELEGRAPH LINE.—The Home Telegraph Company sought to enter the city of Nashville, Tenn., with its plant and telephone lines under the statutes of that state giving authority to telegraph corporations to construct telegraph lines along the public streets or highways of any city, village, etc., but the use of the streets of the city for such purpose was denied the company by the mayor and city council. The company thereupon brought a bill to enjoin the mayor and council from preventing the company's entrance upon and occupance of the streets and the operation of its plant, claiming that the telephone and telegraph are one and the same thing, based upon the same principle, and that the telephone is simply an improved telegraph. It was held that, in law, the two are essentially different and that the statute referred to does not authorize the erection of a telephone line. Home Telegraph Company vs. Mayor and City Council of Nashville, Supreme Court of Tennessee, 101 S. W. Rep. 770.

NEW YORK CONDUITS.—Justice McCall, in Special Term, Part I., of the Supreme Court, New York City, last week, reserved decision on an application to have the Consolidated Electric Subway Telegraph Company adjudged to be in contempt of court for its alleged failure to carry out the directions of the Court of Appeals to provide ducts in its subway for the wires of the Long Acre Light & Power Company. Some time ago Justice Dowling, in the Supreme Court, granted an application for a writ of mandamus commanding the Consolidated Company to give to the Long Acre Company room for its wires. The Court of Appeals affirmed this decision. Former Judge Dittenhoefer, counsel for the Long Acre Company, told Justice McCall that the Consolidated Company had refused to assign wire space to the Long Acre Company, alleging as an excuse that its ducts were filled with wires. Henry J. Hemmens, counsel for the Consolidated Company, opposed the application. He said that the company would build other ducts, provided the Commissioner of Water, Gas and Electricity gave his permission for the additional ducts.

DEGREE OF CARE REQUIRED OF ELECTRIC LIGHT COMPANIES IN WIRING FOR LIGHTING HOUSE.—The defendant company had attached to the house of the father of the plaintiff, directly beneath one of the windows, a device known as a "converter" and had placed in position two iron posts to receive the glass insulators to which were attached the wires used for the purpose of conveying the electric current to the house. The plaintiff, a boy 12 years old, leaning out of the window and seeing that one of the insulators had fallen or been removed from its position, seized hold of the insulator in order to replace it on the iron support. The insulation on the wires had become worn and defective but their dangerous condition was unknown to the plaintiff and, in some manner, his hand came in contact with the uncovered wire and he suffered severe injuries as a result. It was held that the defendant company was not liable in damages. It is not a mere possibility, but a reasonable probability, of accessibility of electrical apparatus used in supplying light to dwellings, etc., to and by children, that invokes the rule that, where electrical appliances are placed where children may come in contact therewith, the person or corporation installing the appliances must exercise the highest degree of care to prevent injury. Denver Consolidated Electric Company vs. Walters, Supreme Court of Colorado, 89 Pac. Rep. 815.

LIABILITY OF PRESIDENT OF ELECTRIC COMPANY FOR MALICIOUS PROSECUTION.—The president of a power company, upon being informed by trustworthy employees that the company's poles were being cut down at a certain point, consulted with an attorney for the purpose of informing himself as to the best method of procedure to save the property of the company. The attorney told him that he was justified in making a complaint before a justice of the peace and that to do so was the only way to proceed. The complaint was accordingly made and the person believed to be guilty of cutting down the poles was arrested. But it was found that the wrong party had been taken into custody and the prosecution was necessarily dropped. The arrested party then brought action to recover damages for malicious prosecution. It was held that there was no ground upon which to base such an action. It is a well settled rule of law that if a person takes the advice of reputable counsel in making a complaint, honestly believing the one charged to be guilty, he has probable cause as a matter of law for his action, or in other words his conduct is consistent with that of a man of ordinary prudence, if the advice of counsel is based on a full and honest statement of the facts and information within such person's knowledge. King vs. Apple River Power Co., Supreme Court of Wisconsin, 111 N. W. Rep. 668.

PATENT FOR MEANS OF SECURING FIELD-MAGNET POLES, VOID FOR LACK OF PATENTABLE INVENTION.—In an action brought by the General Electric Company to restrain an alleged infringement of letters patent No. 571,107, issued Dec. 15, 1896, to Henry G. Reist, for securing field-magnet poles, it was held that the device lacked patentable invention and that the patent granted thereon was invalid. In the specification the invention is described as follows: "My invention relates to securing pole-pieces to revolving field magnet structures, particularly in alternating current dynamos, where the field-magnet poles are made of assembled laminations with a dovetailed tenon upon the ends, so that when they are assembled the pole-piece may be slipped sidewise into the field magnet structure. I then insert keys so as to take up any lost motion between the pole-piece and the field-magnet, the end plates of the poles being provided with overhanging lips

or flanges which serve to retain the field magnet coils in place. I may then remove any field-magnet coil or any pole-piece without removing the field magnet structure as a whole." The court held that the patent involved nothing more than the application of the well known dovetail and key method to the fastening of the laminated pole-pieces of a field-magnet to the yoke thereof. "This method of fastening," said the court, "has been used time out of mind in all kinds of purely mechanical devices, and recently also in dynamos and other electric machinery. The invention does not present any result, whether mechanical, magnetic or electric, which was new. They were all old. Nor was there any combination produced which had the merit of novelty or invention." General Electric Company vs. Bullock Electric Mfg. Co., United States Circuit Court of Appeals, Sixth Circuit, 152 Fed. Rep. 185.

Personal.

MR. J. P. BROWN, superintendent of the Fremont (Neb.) Gas & Electric Company, has resigned.

MR. F. A. BARTON has resigned his position as manager of the Stoughton (Mass.) Gas & Electric Company.

MR. NATHAN FLEISCHER was elected treasurer of the International Steam Pump Company at the recent meeting.

PROF. A. S. RICHEY, of Worcester Polytechnic Institute, was married June 4 to Miss Edith Holman Kendrick at Worcester, Mass.

MR. E. D. ADAMS, of the Allis-Chalmers and other interests, sailed last week for Europe to take a few months of much needed rest and recreation.

MR. A. I. CULVER, formerly vice-president of the Delaware & Hudson, is said to have decided to remain with that company in control of its trolley lines.

MR. J. J. JORDAN has been appointed general manager of the Cleveland, Painesville & Eastern and the Cleveland & Ashtabula Railroads, at Willoughby, Ohio.

MR. J. M. GRAHAM, vice-president of the Erie Railroad, has received from Kentucky State College, of which he is an alumnus, the honorary degree of Doctor of Engineering.

MR. SAMUEL McROBERTS, who has been made president of the Chicago Subway Company, is confidential secretary to Mr. J. O. Armour and is prominent in various Armour enterprises.

MR. H. McCULLOUGH, electrical engineer for the Toledo Mining & Power Company, of Sheridan, Mont., has taken charge of the electrical work for the Pittsburgh & Montana Mining Company, of Butte, Mont.

MR. SAMUEL B. McLENEGAN, formerly superintendent of the Inter-Urban Railroad Company, of Los Angeles, Cal., has been appointed general manager of the Central California Traction Company, of Stockton, Cal.

MR. W. S. BARSTOW, of W. S. Barstow & Company, 50 Pine Street, has just returned from a six weeks' business trip through the Pacific Coast states, and was able to attend the recent electric light convention in Washington.

MR. CHARLES E. WHITE, formerly superintendent of the Wakefield Municipal electric light plant, Wakefield, Mass., has been appointed head of the new business department of the Union Gas & Electric Company, of Cincinnati, Ohio.

MR. C. G. CURTIS, the inventor of the Curtis steam turbine and a graduate of Columbia University, was made a Master of Science at the commencement exercises of his alma mater last week in recognition of his standing and achievements as an engineer.

GENERAL A. R. WARNER, formerly president of the North Georgia Electric Company, of Atlanta, has resigned from the board of directors of that corporation. It is stated on good authority that the dissensions in the management of the company have been definitely settled.

MR. HOWARD H. CROWELL, expert on the staff of the New York State Commission of Gas and Electricity, has been retained by Mayor Thompson, of Detroit, to investigate the supply of electricity on public account to that city by the Detroit Edison Company.

MR. A. W. Q. BIRTWELL, assistant treasurer of the Houston Electric Company, of Houston, Tex., has resigned to become assistant treasurer of the Northern Texas Traction Company at Fort Worth, Tex. Mr. H. L. Harding will succeed Mr. Birtwell as assistant treasurer of the Houston Electric Company.

MR. CALVIN W. RICE, secretary of the American Society of Mechanical Engineers, sailed for Europe last week with his wife, who is in poor health, and will stay some months at one of the German spas to take the waters and treatment. Mr. Rice will return home and then go back later for Mrs. Rice.

MR. G. W. NEWMAN has resigned his position as superintendent of the North East Electric Light & Power Company, North East, Pa., to take effect July 1, when he will assume the position of general manager of the plant of the Edina Electric Light & Power Company, which was recently purchased by Mr. Newman and associates.

MR. SAMUEL W. BOWERMAN, who for some time represented the Stanley Electrical Manufacturing Company and the General Incandescent Arc Light Company in Philadelphia, has lately established an office in the Real Estate Trust Building, Philadelphia, to sell electrical apparatus, acting as agent for the General Electric Company's motors.

PROF. H. T. BOVEY, dean of the faculty of physics of McGill University, Montreal, has been visiting the United States with his daughter, Miss Bovey, and his niece, Miss Fleet, of England. Great success has attended his efforts to secure books for the new engineering library and contributions for the new engineering building; and Dr. Bovey hopes, within two years, to remove all traces of the disastrous fire that destroyed the entire engineering equipment.

MR. C. F. CUTLER.—By the will of the late Charles Francis Cutler, head of the New York and New Jersey Telephone Company, which has just been admitted to probate by the Morris County Surrogate, his widow, Ella Poole Cutler, receives all his personal belongings, also $25,000 in lieu of dower. To his nephew, Charles Henry Cutler, of Newark, he bequeathed $1,000; to his nephew, Dr. Charles Cutler, of Chelsea, Mass., $1,000, and to his friend, S. S. Davenport, of South Framingham, Mass., $500. To each servant employed for five years $100 is left. The residue is left to Mrs. Cutler for her use and the support of their son, Earl Newton Cutler. The estate is valued at $1,000,000.

Trade Publications.

CANTON-HUGHES PUMPS.—The Canton-Hughes Pump Company, of Canton, Ohio, has just issued a 64-page booklet devoted to its stamp pumps and hydraulic machinery.

HASCHKE STORAGE BATTERY.—The Haschke Storage Battery Company, 598 Monroe Street, Chicago, affiliated with the Auto-Buggy Works at the same address, has issued a circular showing the application of the Haschke compound storage battery to automobile and power boat work.

WESTINGHOUSE INDUSTRIAL PAMPHLETS.—Two recent additions to the Westinghouse Industrial Series of pamphlets have for their subjects the electrical equipment of machine shops and cement works. One describes the electrical equipment of machine tools in the plant of the Firth-Sterling Steel Company, and the other is a description of the electrical equipment of the Bath (Pa.) Portland Cement Company.

NERNST LAMP INSTALLATIONS.—Two recent publications of the Nernst Lamp Company are beautiful specimens of the pamphlet art in cover, type, illustrations and paper. One is entitled "A Departure in Office Buildings," and describes the Larkin Building in Buffalo and its lighting by Nernst lamps. The other, entitled "Electric Lighting in the Department Store," describes and illustrates the lighting of a number of department stores in different cities.

COMMUTATING-POLE RAILWAY MOTORS.—Bulletin No. 4508, of the General Electric Company, Schenectady, N. Y., is devoted to commutating-pole, direct-current motors. These motors are now offered in ratings ranging from 50 hp to 200 hp for 600 volts. It is claimed that in comparison with the usual type the commutating-pole motor shows less wear on the commutator, marked reduction in the heating of the commutator, increased life of the brushes, flashing at the commutator largely reduced, if not entirely eliminated; increased efficiency and free running capacity because of lower core and commutator losses, practically sparkless commutation even on heavy overloads, and greater service capacity of motors possible by use of forced ventilation.

Business Notes.

ALLIS-CHALMERS.—The Allis-Chalmers Company gives notice that its office at Seattle, Wash., which was in charge of Mr. G. N. Pulver, district manager, has been moved to 115 Jackson Street, that city.

H. M. BYLLESBY & COMPANY have been retained as consulting and supervising engineers by the Mobile & Ohio Railroad Company for the rehabilitation and electrification of its general repair shops at Whistler, Ala.

THE NATIONAL TELEPHONE DIRECTORY COMPANY, of Wisconsin, with a capital stock of $25,000, of which $12,000 is to be employed in Missouri, with an office in St. Louis, Mo., has been authorized to do business in this state.

THE NORTHERN ENGINEERING WORKS, Detroit, Mich., recently shipped to the Denver & Rio Grande Railroad Company a second 3-motor, electric-traveling, 15-ton crane of special construction for use in the roundhouse of that company. The crane uses alternating current equipment, and is designed to run on an overhead curved track.

THE MONARCH TELEPHONE COMPANY, of Chicago, Ill., has been granted a permit to do business in Texas. The capital stock of the company is $100,000 and the directors are John E. Nordling, Julius C. Hubacher and Ernest E. Yaxley, of Chicago, Ill. The company proposes to manufacture telephone instruments and supplies.

STROMBERG-CARLSON.—The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., prepared for the independent telephone convention at Chicago, and has also distributed widely some clever souvenirs made up as transmitter mouthpieces in colors on cardboard and also prepared as postal cards.

RIDGWAY AGENCY.—The Ridgway (Pa.) Dynamo & Engine Company, builders of the McEwen engine and the Thompson-Ryan dynamo, has appointed Samuel W. Hay's Sons, 302 Farmer's Bank

Building, as its Pittsburg sales agents. The territory assigned to this office is the Pittsburg district, Southeastern Ohio and Northern West Virginia.

THE HOLOPHANE COMPANY, sales department, 227 Fulton Street, New York City, has just opened a branch office at 157 Minna Street, San Francisco, Cal., under the management of Mr. F. H. Poss, who is well known to the trade on the Pacific Coast. It intends to carry a large line of globes and reflectors at this office, which will enable it to make prompt deliveries, this being in keeping with the well-known policy of the Holophane Company. Only standard packages will be sold. Owing to the demands of increased business the Holophane Company's sales department has recently enlarged its office. It now occupies the eighth and ninth floors of the Glackner Building, 227 Fulton Street, New York City.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED JUNE 11, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

NOTE.—The first four patents were issued June 4, and inadvertently omitted from last issue.

856,010. ELECTROPNEUMATIC BRAKING DEVICE FOR RAILWAY CARS; Ragnar Wikander, Westeras, Sweden. App. filed Dec. 26, 1906. Provides an electropneumatic braking device in which only one valve body is required and in which an automatic adjustment of the braking pressure can be effected by means of each of two controlling systems.

856,012. MEANS OF TESTING INSULATED WIRES; Newton A. Wolcott, Warren, Ohio. App. filed May 5, 1906. Provides means for detecting imperfections in the insulation of wires or cables without actually energizing the core save where there is imperfect insulation. Has two dielectric contacts with which the cable engages and means for supplying to such contacts a current of a potential less than the voltage of the two diclectrics in series but sufficient to energize one contact when the other contact energizes the core of the cable.

856,054. ELECTRICALLY HEATED STOVE; Fritz Gutjahr, Berlin, Germany. App. filed June 13, 1906. Construction of stove provided with an electric lighting device. A casing having substantially the form of an ordinary radiating stove. Has resistance coils in place of the usual furnace, etc.

856,071. ELECTRIC SIGNAL; George Langlume, New Orleans, La. App. filed Oct. 6, 1906. Provides an electric signal designed to give an alarm in the event of a vacuum tube or condenser ceasing to work so that it will be unnecessary for the engineer to watch the gage. Has a circuit closing plunger which is normally held raised by the vacuum.

856,260. TELEPHONE APPARATUS; William Kaisling, Chicago, Ill. App. filed April 9, 1903. Relates to details of construction and arrangement of telephone switch hook and induction coil.

856,265. KEYBOARD TRANSMITTER; John C. Kunkle, Brooklyn, N. Y. App. filed June 21, 1905. The combination with a transmitter character bar, having two or more characters, of a transmitter arm adapted to be brought into operative relation with either of said characters, and means for shifting the arm to permit the transmission of the desired character.

856,273. RAILWAY SWITCHING SYSTEM; William Macomber, Buffalo, N. Y. App. filed Feb. 20, 1905. Provides for moving and locking a rail switch and producing the indication of the movement thereof, and the fact of its locked condition.

856,275. HIGH-TENSION ELECTRIC FIXTURE; Albert S. Marten, East Orange, N. J. App. filed Nov. 27, 1903. Relates to the supporting portion of fixtures employed for high-tension electric lamps. Aims to secure convenience in installing or repairing the lamps and avoids a large number of parts. Has bent arms integrally depending from a cap or plate.

856,277. ELECTROLYTIC TANK; John F. Miller, Trail, B. C., Canada. App. filed Feb. 6, 1906. Relates to tanks or vessels for electrolytic work, such as the electrolytic refining of metals. Provides a wooden tank having special features of construction in the joints thereof whereby it is cheap, compact and water-tight.

856,290. SIGNALING MECHANISM; Walter A. Pearce, London, England. App. filed Nov. 28, 1906. Relates to signaling mechanism. Provides an improved form of electrically controlled coupling between the operating rod and the rod which is connected to the signal.

856,292. SAFETY FUSE; William J. Phelps, Detroit, Mich. App. filed May 4, 1903. The fuse casing has a transparent window therein, which is coated with chloride of lime, and a copper fuse is employed so that the fumes thereof will act on the lime and discolor it to produce an indication.

856,293. TROLLEY POLE CONTROLLER; Andrew L. Prentiss, Buffalo, N. Y. App. filed Sept. 24, 1906. A pneumatic retrieving cylinder is fixed to operate horizontally at the base of the pole and has a plunger with a link connection to a crank or arm extending downward from the pole. Has tripping means for admitting air to the retrieving cylinder.

856,321. ELECTRICAL CONTACT JOINT; Reinhold H. Wappler, New York, N. Y. App. filed June 21, 1906. A support for miniature electric lamps by which they may be adjusted in any position without interrupting their electric circuit. Employs a ball and socket joint in which the ball comprises two hemispherical cups insulated from one another and co-operating with spring blades in the socket.

856,324. RAILWAY SWITCH OPERATING AND SIGNALING SYSTEM; Asbury G. Wilson, Wilkinsburg, Pa. App. filed Sept. 6, 1905. An electric operating mechanism for switches of the interlocking type.

856,328. THERMOSTATIC APPARATUS; Edward F. Woodman, Boston, Mass. App. filed Nov. 17, 1906. Form of thermostatic apparatus wherein a fusible material is employed, as distinguished from thermostatic apparatus wherein a more or less volatile liquid is used as the element to be acted upon by a rise of temperature. Has a cup with a spring impelled plunger and containing the fusible substance.

856,335. CABLE ROLLER; William Callahan, Quincy, Ill. App. filed Mar. 28, 1906. The sheeve or pulley for the cable is suspended from the usual messenger wire by special form of clamping mechanism, including eccentric sleeves.

856,351. PROCESS OF REDUCING IRON OXIDS; Horace W. Lash, Cleveland, Ohio. App. filed Oct. 13, 1905. The method of reducing iron oxids comprising intimately mixing finely divided oxid of iron with finely divided cast iron and carbonaceous material, charging the same into an electric furnace and subjecting the mixture to a smelting heat.

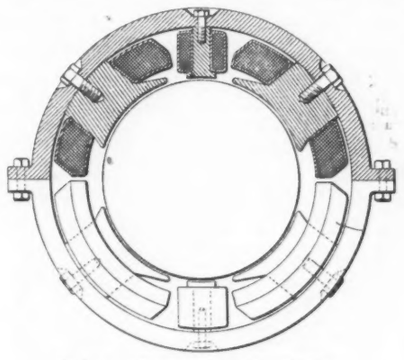
856,361. APPARATUS FOR ELECTROCHEMICALLY AND MECHANICALLY PURIFYING LIQUIDS; Gustave L. Neiburg, Westpoint, Neb. App. filed May 25, 1906. A liquid purifying means comprising two tubular members, one formed of zinc and the other of copper, and located within one another, and through which the fluid passes.

856,379. MEANS FOR COOLING ELECTRIC MOTORS; John B. Wiard, Lynn, Mass. App. filed Oct. 16, 1906. In a motor, a stator or field ring, bonnets secured to the end of said ring, a rotor or armature mounted in bearings in said bonnets, and a tubular coil for receiving a cooling fluid nested within one of said bonnets.

856,385. INSULATING COVERING OR SHEATHING FOR CONTACT RAIL CONDUCTORS; William H. Baker, Lockport, N. Y. App. filed Mar. 21, 1906. Relates to insulating coverings or sheathings for contact conductors to be used in third rail or underground systems. The rail is designed to be covered, except on its bottom surface, by a special lap-jointed covering which makes provision for the enlargements due to the fish plates.

856,386. AUTOMATIC CALLING DEVICE; William O. Beck, Chicago, Ill. App. filed June 4, 1906. The combination with controlling mechanism, of means adapted to set the same, mechanism for operating said controlling mechanism after the same is set, and a device for rendering said means inoperative until the operation of said controlling mechanism is completed.

856,393. INCLOSED FUSE; Robert C. Cole, Hartford, Conn. App. filed Dec. 10, 1906. An enclosed device having a tubular casing and a metallic terminal therefor comprising an end closure for said casing, a projecting contact member fastened by its end to said closure, and a back plate reinforcing the joint between said member and end closure.



856,414—Dynamo Electric Machine.

856,412. ELECTRIC METER; Arthur J. Martin, Rugby, England. App. filed Nov. 2, 1906. Provides a supplemental magnet for weakening the field strength on light loads. This weakening of the field strength decreases the counter e.m.f. per revolution and consequently increases the speed of the meter. This compensates for the effect of friction at the light loads.

856,414. DYNAMO-ELECTRIC-MACHINE; Charles A. Mudge, New York, N. Y. App. filed Aug. 24, 1906. A construction of dynamo-electric-machine having spaces of different extent between the cores of the main field poles, and an interpole located in the larger interpole space.

856,417. ELECTRICAL CONTROLLER FOR STEAM PLANTS, etc.; John A. Olson, Minneapolis, Minn. App. filed Mar. 20, 1905. Form of electrical controller adapted for use as an automatic heat regulator for opening and closing the valve of a steam or hot water heating system. Has electrical contacts in the path of the steam pressure gauge index hand or pointer.

856,423. VENTILATING DYNAMO-ELECTRIC MACHINES; Henry G. Reist, Schenectady, N. Y. App. filed Mar. 1, 1905. In a dynamo-electric machine, a rotating shaft, a bearing therefor, a core or body carried by the shaft, fan blades secured to the end of the core or body adjacent the bearing, and a shield carried by the core and extending to the bearing.

856,424. CONTROLLING AN ELECTRIC CANDY SPINNING MACHINE; Albert D. Robinson, Lynn, Mass. App. filed Sept. 6, 1905. Has a single switch controlling both the driving motor and the heater and operating to start the motor before the heater is put into circuit.

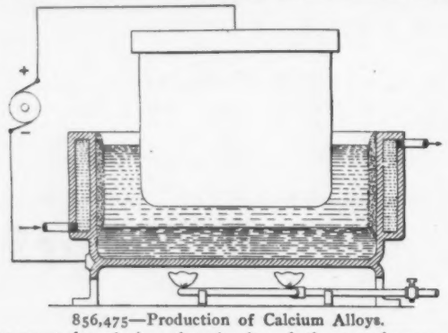
856,425. CIRCUIT BREAKER; Benjamin P. Rucker, Wilkinsburg, Pa. App. filed Sept. 22, 1904. A tubular arm is pivoted to swing outwardly from a vertical position where it closes the circuit. Contains a solenoid and plunger which is drawn upward to release a detent to prevent such outward movement of the arm.

856,429. COMMUTATOR BRUSH; Robert Siegfried, Pittsburg, Pa. App. filed Jan. 3, 1905. A carbon block is first perforated with a longitudinal hole or recess and a cylindrical piece of gauze is expanded into this hole by a drift pin.

856,430. SYSTEM OF ELECTRICAL DISTRIBUTION; Simon B. Storer, Syracuse, N. Y. App. filed Nov. 23, 1904. A system of electrical distribution comprising a source of polyphase electrical energy and distributing conductors that are respectively connected to the middle points, to the extremities and to intermediate points in windings with which the said source of energy is provided, the middle points of the generator windings being connected together and grounded.

856,433. CENTRIFUGAL SWITCH FOR ELECTRIC MOTORS; Knut Tornberg, Lynn, Mass. App. filed July 10, 1905. Provides an arrangement of switch for induction motors in which the contact carried by the centrifugally movable member of the switch is moved by said member substantially at right angles to a centrifugal direction. In this way the pressure between the electrical contacts is in no wise dependent on the centrifugal force.

856,440. BLOCK SIGNAL SYSTEM; Elmer F. Bliss, Schenectady, N. Y. App. filed Dec. 5, 1906. Has various features, including an



856,475—Production of Calcium Alloys.

arrangement for closing the circuits of the transformers ahead of the train whereby a plurality of transformers may be controlled through a single conductor or pair of conductors.

856,441. MAXIMUM DEMAND INDICATOR; Francis H. Bowman, Pittsfield, Mass. App. filed Nov. 13, 1906. A maximum demand indicator of the type in which a conductor carrying the current to be measured, heats a portion of a tube containing liquid, thereby expanding the gas therein, which causes the liquid to spill over into an adjacent receptacle which is graduated to indicate the amount spilt.

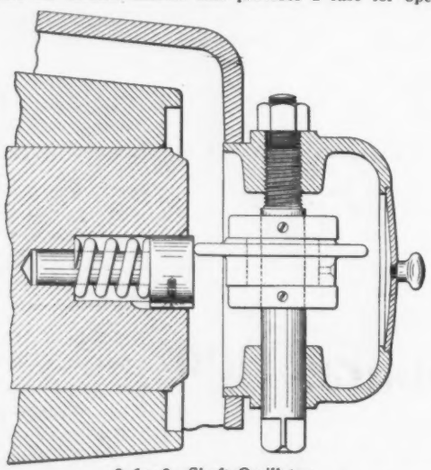
856,448. CONTROL SYSTEM FOR ELECTRIC VEHICLES; William Cooper, Wilkinsburg, Pa. App. filed Oct. 3, 1906. System of electric motor control having means for automatically interrupting the supply of energy to the motors upon the occurrence, for any reason, of a material difference in the motor speeds.

856,465. BLOCK SIGNAL SYSTEM; Laurence A. Hawkins, Schenectady, N. Y. App. filed Dec. 3, 1906. Signal system having track rails energized by transformers connected in a special way across the leads of a three-wire system.

856,466. BLOCK SIGNAL SYSTEM; Laurence A. Hawkins, Schenectady, N. Y. App. filed Jan. 11, 1907. Relates to modifications of the above.

856,475. PRODUCTION OF CALCIUM ALLOYS; Franz Von Kugelgen and George O. Seward, Holcombs Rock, Va. App. filed Mar. 30, 1905. The process which consists in electrolyzing a molten calcium salt in the presence of a cathode of fused zinc, whereby is produced an alloy of calcium and zinc.

856,476. ELECTRICAL CONTROLLER; George Laird and John P. Todd, Manchester, England. App. filed Feb. 4, 1905. Relates to controllers for electric motors and provides a fuse for opening the



856,538—Shaft Oscillator.

main circuit, either when the current exceeds a predetermined limit or when the voltage falls below a desired value.

856,477. ALTERNATING CURRENT MOTOR; Benjamin G. Lamme, Pittsburg, Pa. App. filed Feb. 27, 1904. In an alternating current motor, the combination with a primary member having a window adapted to procure a plurality of numbers of magnetic poles and means for changing from one number to another, of a secondary member having a plurality of windings of different resistance that are respectively effective for different numbers of poles in the primary member.

856,483. AUTOMATIC GAS-FEED FOR VACUUM-TUBE LAMPS; D. M. Moore, Newark, N. J. App. filed May 8, 1906. The method of maintaining a gas tension or density of a vacuum tube lamp at normal by supplying gas thereto in accordance with variations in the intensity of the light of said tube.

856,484. AUTOMATIC GAS-FEED FOR VACUUM-TUBES; D. M. Moore, Newark, N. J. App. filed May 8, 1906. The combination of a vacuum tube, a thermostat heated by current varying in amount with the resistance of the gas in the tube, and means controlled by said thermostat for supplying gas to the tube in regulated amounts so as to maintain the gas tension or density therein at substantially normal degree.

856,488. INSULATOR; Charles L. Peirce, Jr., Chicago, Ill. App. filed Jan. 29, 1906. A support or pin for a glass insulator, comprising a piece of angle iron surrounded by a coiled metal spring, the ends of which engage holes in the angle iron.

856,504. KEYBOARD TELEGRAPH TRANSMITTER; Richard Wolters, Dusseldorf, Germany. App. filed Dec. 5, 1906. Relates to a keyboard telegraph transmitter so constructed that the contact slide is moved along the contact rail with regularity, and without undue speed, or even if the key is rapidly depressed.

856,535. TROLLEY POLE FOR CONDUCTING ELECTRIC CURRENT TO VEHICLES; Robert and John Lindsay, Dunedin, New Zealand. App. filed June 26, 1905. Construction of trolley pole formed of sections adapted to telescope longitudinally and spring pressed outward, whereby the pole may be reversed without removing the trolley wheel from the wire.

856,538. SHAFT OSCILLATOR; Charles E. Lord and William F. Bouche, Norwood, Ohio. App. filed Jan. 25, 1905. The end of the motor shaft has a spring impelled stud therein which engages a disc revolving in a horizontal plane at the end of the shaft.

856,540. STARTER FOR ELECTRIC MOTORS; William C. Mayo and John Houlehan, El Paso, Tex. App. filed Feb. 11, 1907. Starter for electric motors designed for direct-current, shunt-wound motors. Provides means which will automatically cut out the resistance in accordance with the variations in line current due to the speeding up of the motor.

856,566. WINDING FOR ELECTRICAL APPARATUS; Miner Barcus, Schenectady, N. Y. App. filed Oct. 31, 1906. A construction of winding for reactance coils and transformers by which eddy currents are avoided.

856,570. TELEPHONE SYSTEM; F. B. Cook and J. G. Nolen, Chicago, Ill. App. filed Feb. 2, 1903. In a telephone system, the combination of a subscriber's line circuit, means for supplying current to said circuit, a line lamp signal associated with the line at the central station, a normally open local circuit, including said lamp and source of current, and a non-inductive circuit-closing device adapted to be operated by current flowing through said line circuit and adapted for closing said local circuit.

856,583. BLOCK SIGNAL SYSTEM; Laurence A. Hawkins, Schenectady, N. Y. App. filed Nov. 8, 1906. A block signal system in which the rails are conductively continuous for all currents. Has transformers and signal controlling relays connected to the rails, and normally open switch contacts in circuit with said transformers and arranged to be closed by an approaching train.

856,640. OUTLET BOX; Samuel E. Huntting, San Francisco, Cal. App. filed April 12, 1906. Relates to the installing of electric switch plates and switches of the "flush" type in the walls of buildings in course of construction. Has flanges at the top and bottom between which the laths pass, thus supporting the frame.

856,666. SUPPORT FOR ELECTRIC SWITCHBOARDS; Romaine L. Warner, Rockford, Ill. App. filed Oct. 26, 1905. Relates to details of construction of brackets by which switchboard panels are supported on vertical posts.

856,670. BLOCK SIGNAL SYSTEM; Charles C. Anthony, Philadelphia, Pa. App. filed Nov. 28, 1906. Provides means for controlling the train movements in either direction of a block comprising two stations and a single connecting main track and having one or more sidings entering said track between the stations.

856,736. ELECTRICAL HEATER AND EXPANSION COIL; Milton H. Shoenberg, San Francisco, Cal. App. filed Sept. 13, 1906. A receptacle has a plurality of parallel tubes passed therethrough which contain spiral resistance elements. The tubes are connected in series at their ends whereby the current traverses the resistance elements of all.

856,737. ELECTRIC CONTROLLER; Richard Van R. Sill, Newark, N. J. App. filed Mar. 6, 1907. Features of construction of a controller for street cars, etc., including roller contacts spring pressed together and which embrace sector blades on the controller shaft.

856,741. LOAD EQUALLIZER FOR GENERATORS; Severn D. Sprong, Brooklyn, N. Y. App. filed Mar. 26, 1906. Automatically maintains a uniform distribution of load between generating units operating in parallel, or any other distribution of load between said units.

856,755. ELECTRIC LAMP SOCKET; Joseph Amon, New York, N. Y. App. filed Mar. 1, 1906. Details of construction of an electric lamp socket having a porcelain block with the threads for the lamp molded directly therein. The contact is made by lateral spring blade.

856,782. THIRD RAIL FOR ELECTRIC RAILWAYS; William F. Kemper, Chicago, Ill. App. filed Jan. 21, 1907. A cover adapted to overlie the third rail and protect the same from snow and ice. Means are provided for shifting the cover during the passage of a train.

856,801. INSULATOR; Charles L. Peirce, Jr., Chicago, Ill. App. filed Jan. 29, 1906. Relates to modifications of No. 856,488.

856,807. ELECTRIC HEATER; Joseph S. Reynolds, Santa Barbara, Cal. App. filed Jan. 30, 1907. A resistance element including a sheet of asbestos and resistance wire threaded therethrough in parallel rows.

856,837. TELEGRAPH APPARATUS; Victor C. Balding, Little Rock, Ark. App. filed Mar. 12, 1906. An instructing device for telegraph operators by means of which the movement of the contact lever of a sounder may be recorded upon a tape or ribbon in such a manner that said record may be transmitted to another sounder. Includes means for perforating the tape.

856,921. ELECTRIC FIRE ALARM; Isaac M. Simons, Youngstown, Ohio. App. filed Feb. 26, 1907. A switch blade is normally held in a position to open the circuit by a strip of fusible material which melts when exposed to undue temperature.

856,924. FIRE AND BURGLAR ALARM; Bernard Staub, New York, N. Y. App. filed Sept. 14, 1906. A burglar alarm system designed to be of very simple construction and easy installation. Has an annunciator and threads or cords connecting the same to various points to be protected.

856,933. ELECTRICAL INTERRUPTER AND RECTIFIER; Harold A. Yarnell, Los Angeles, Cal. App. filed June 16, 1905.

856,955. SPRING-JACK MOUNTING PLATE; Harry P. Hibbard, Chicago, Ill. App. filed Oct. 28, 1905. The combination with a spring-jack supporting plate, of angular clamping lugs formed of sheet metal secured at the ends of said plate.